97TH CONGRESS } HOUSE OF REPRESENTATIVES { REPORT
2d Session } { No. 97-501

AUTHORIZING APPROPRIATIONS TO THE NATIONAL BUREAU OF STANDARDS FOR FISCAL YEAR 1983

MAY 5, 1982.—Committed to the Committee of the Whole House on the State of the Union and ordered to be printed

Mr. FUQUA, from the Committee on Science and Technology, submitted the following

REPORT

[To accompany H.R. 5726]

[Including cost estimate of the Congressional Budget Office]

The Committee on Science and Technology, to which was referred the bill (H.R. 5726) to authorize appropriations for activities of the National Bureau of Standards, and for other purposes, having considered the same, reports favorably thereon with amendments and recommends that the bill as amended do pass.

The amendments are as follows:

Page 3, line 10: strike quotation mark after "Technology," and insert quotation mark after "(Robotics)"

Page 4, line 3: strike "1,600,000" and insert "1,898,000"

PURPOSE OF THE BILL

The purpose of the bill is to authorize appropriations for fiscal year 1983 to the National Bureau of Standards and related agencies out of money in the Treasury not otherwise appropriated, as shown in the following table.

	Authorization fiscal year 1983
National Bureau of Standards:	
Measurement research and standards	$50,389,000
Engineering measurements and standards	21,012,000
Computer science and technology	12,731,000
Core research program for innovation and productivity	11,586,000
Technical competence fund	8,986,000
Fire research center	4,991,000
Central technical support	14,324,000
Subtotal, NBS	124,019,000
National Technical Information Service	1,980,000
Office of Productivity, Technology, and Innovation	1,898,000
Total, H.R. 5726	127,897,000

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1. SUMMARY OF COMMITTEE ACTIONS

COMMITTEE BUDGET ACTIONS

The following Committee actions are reflected in the Bill H.R. 5726.

BUDGET TOTAL

The President's budget for fiscal year 1983 included a request for $111.5 million in new obligational authority for the National Bureau of Standards, $1.9 million for the National Technical Information Service, and $1.9 million for the Office of Productivity, Technology and Innovation, for a total of $115.3 million. This represents a $10.8 million reduction from the fiscal year 1982 programs.

H.R. 5726 includes new obligational authority for the National Bureau of Standards totalling $124.0 million. This sum is $3.7 million above the appropriation for FY 1982 and $12.5 above the President's request for FY 1983. The Committee bill for FY 1983 would authorize $1.9 for the National Technical Information Service, which is identical to the President's request, and represents a reduction of $2.8 compared with FY 1982. H.R. 5726 would authorize $1.9 for the Office of Productivity, Technology and Innovation, the same amount as the President's request for FY 1983, representing an increase of $402,000 over FY 1982.

In addition, the bill authorizes excess foreign currencies in the amount of $500,000 for the programs of the National Bureau of Standards.

INCREASES IN H.R. 5726 FOR NBS

The bill, as adopted by the Committee, reflects the following increases increases in the President's budget:

Measurement Research and Standards would be increased by $409,000 from the NBS request of $49.9 million to $50.3 million.

Engineering Measurements and Standards would be increased by $205,000 from the NBS request of $20.8 million to $21.0 million.

Computer Science and Technology would be increased by $5.6 million from the NBS request of $7.1 million to $12.7 million.

Core Research Program for Innovation and Productivity would be increased by 4.3 million from the request of $7.2 million to $11.5 million.

Technical Competence Fund would be increased by $2.0 million from the NBS request of $6.9 million to $8.9 million.

SPECIFICATIONS

Minimum and maximum funding levels are included in the bill for the following programs:

Of the $50.3 million authorized by the bill for Measurement Research and Standards not less than $1.2 million would be available for the Office of Weights and Measures and not less than $500,000 would be available for the program of Measurement Standards for the Handicapped.

Within the $21.0 million authorized by the bill for Engineering Measurements and Standards not less than $500,000 would be available for the program of Earthquake Hazards Engineering, and not less than $500,000 would be available for the program of Measurement Standards for the Handicapped.

Of the $12.7 million authorized by the bill for Computer Science and Technology, not less than $10 million would be available for this program.

Of the $11.5 million authorized by the bill for the Core Research Program for Innovation and Productivity, not less than $3.0 million is authorized for Automated Manufacturing Research Facility and $3.2 million for Discrete Process Technology (Robotics), and not more than $1.5 million would be authorized for transfer to the Working Capital Fund.

Of the $14.3 million authorized by the bill for Central Technical Support, not more than $3.886 million would be available for transfer to the Working Capital Fund.

COMPARISON WITH BUDGET REQUESTS

Committee actions on the President's budget request for the National Bureau of Standards and related activities are reflected in the table below:

NATIONAL BUREAU OF STANDARDS AND RELATED AGENCIES.—FISCAL YEAR 1983 BUDGET HISTORY

[Fiscal years, in thousands of dollars]

	Fiscal year 1982 appropriation	Administration fiscal year 1983 request	Administration changes	Fiscal year 1983 committee bill	Committee bill compared to—	
					Fiscal year 1982 appropriation	Administration budget request
Measurement research and standards	49, 567	49, 980	0. 413	50, 389	0. 822	0. 409
Engineering measurements and standards	19, 450	20, 807	1, 357	21, 012	1, 562	. 205
Computer science and technology	12, 024	7, 131	—4, 893	12, 731	. 707	5, 600
Core research program for innovation and productivity	11, 111	7, 274	—3, 837	11, 586	. 475	4, 312
Technical competence fund	7, 597	6, 986	—. 611	8, 986	1, 389	2, 000
Fire research center	1, 391	4, 991	3, 600	4, 991	3, 600	0
Central technical support	19, 138	14, 324	—4, 814	14, 324	—4, 814	0
NBS subtotal	120, 278	111, 493	—8, 785	124, 019	3, 741	12, 526
NTIS	4, 772	1, 980	—2, 792	1, 980	—2, 792	0
OPTI	1, 198	1, 898	. 700	1, 898	. 402	—. 298
Total	126, 248	115, 371	—10, 877	127, 897	1, 351	12, 228

OTHER COMMITTEE ACTIONS

The following Committee actions which would provide for the use of appropriations made available to the National Bureau of Standards and for other purposes are also reflected in the bill H.R. 5726.

FINANCIAL PROVISIONS

A provision clarifying how a shortage of funds for possible salary increases in fiscal year 1983 is to be dealt with is incorporated as Section 6.

A provision specifying that funds appropriated under this Act shall remain available as specified in the Appropriations Act is incorporated as Section 7.

A provision permitting transfers of funds between program line items is incorporated in the bill as Section 8.

A provision directing the Secretary of Commerce to charge for services mandated by law to be performed by the Bureau or requested by another Agency of the Government is incorporated in the bill as Section 9.

2. COMMITTEE BUDGET ACTION

NATIONAL BUREAU OF STANDARDS

The Committee expresses the following views regarding budget actions for the National Bureau of Standards.

Overall NBS Budget Level

The National Bureau of Standards (NBS), the Nation's oldest national laboratory and the lead agency for measurement science and standards, was created 83 years ago (P.L. 56-177) to meet the need for a nationally unified system of physical measurement. Subsequent legislative directives, including major changes in the Organic Act in 1950, 1972 and 1974, have extended NBS measurement responsibilities so that they impact on domestic and international trade, industrial and government productivity, public health and safety, effective utilization of materials, and the advancement of science.

The Bureau is expected by the Congress to make substantial contributions in these broad issue areas. A consistent pattern has emerged in which many Federal agencies turn to NBS for advice on measurement and standards-related problems related to the technological programs of such agencies. Thus, a dual role for NBS has come about. On one hand, NBS provides the measurement base that increases the efficiency of science, technology and industry, and on the other hand, NBS provides technical assistance to meet the needs of a host of Federal agencies in achieving their individual objectives. The Committee supports the maintenance and further development of this dual role.

In view of the Bureau's strategic role in the country's efforts to increase productivity and achieve a higher level of industrial innovation, the Committee recommends a FY 1983 NBS budget of $124,019,000. This is 3.1% (or $3.7 million) over the amount appropriated for FY 1982 whereas the Administration has proposed a budget cut of 7.3% (or $8.8 million).

The Committee accepts the proposed cuts in the programs for Recycled Materials, Environmental Measurements, and one half of the cut proposed for Metals Processing, totalling about $9.6 million. This total also reflects a reduction of $4,814,000 due principally to the anticipated completion of the NBS mainframe computer procurement in FY 1982.

The bill would authorize increases in cost of living (mandated salary increases, fuel costs, etc.) in all programs in the amount of $6,795,000, and program increases for the Office of Weights and Measures, Measurement Standards for the Handicapped, Computer Science and Technology, Automated Manufacturing, Robotics, and Technical Competence Funding in the amount of $6,547,000. The elimination of funding by the Federal Emergency Management Agency (FEMA) for the NBS Fire Research Center (FRC) has led to an increase in direct funding by NBS for the FRC in the amount of $3,600,000.

LINE ITEM AUTHORIZATION

The authorization for the National Bureau of Standards is provided in 7 separate line items in Section 2(a) of the bill. These line items correspond to the major categories of the Bureau's total program, and are described below.

MEASUREMENT RESEARCH AND STANDARDS

The measurement research and standards activity is performed by NBS's National Measurement Laboratory (NML). The NML is a vital organizational unit of the Bureau. It provides a national system of physical and chemical measurement; coordinates that system with measurement systems of other nations; furnishes essential services leading to accurate and uniform physical and chemical measurements throughout the Nation's scientific community, industry, and commerce; conducts materials research leading to improved methods of measurements, standards, and data on the properties of materials needed by industry, commerce, educational institutions, and government; provides advisory and research services to other Government agencies; conducts physical and chemical research; develops, produces, and distributes standard reference materials; provides standard reference data; provides calibration services; and collaborates with the Bureau's major organizational units in carrying out its responsibilities. The Committee believes that these contributions can only enhance our country's role to improve measurement standards throughout industry and government, and the bill would authorize $50,389,000 for this activity.

ENGINEERING MEASUREMENTS AND STANDARDS

The National Engineering Laboratory (NEL) conducts the engineering measurement and standards activity of the Bureau. NEL provides technology and technical services to public and private sector entities as they address national needs in areas such as public health and safety, regulatory reform, energy utilization, defense, productivity, and international trade. To support this effort, the NEL conducts research in engineering and applied science, builds and maintains competence in the disciplines required to carry out this research and technical service, develops engineering data and measurement capabilities, provides engineering measurement traceability services, develops test methods, and proposes engineering standards and code changes. The NEL also proposes new engineering practices, improves mechanisms to transfer results of its research to the ultimate

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users, and develops and demonstrates new institutional practices to stimulate the use of technology. Thus, the NEL plays a lead role in providing technical services and data which help to boost the Nation's productivity. The bill includes $21,012,000 for the efforts of the National Engineering Laboratory.

COMPUTER SCIENCE AND TECHNOLOGY

The Institute for Computer Sciences and Technology (ICST) conducts the computer science and technology program. Under authority provided to the Secretary of Commerce by P.L. 89–306 (Brooks Act), ICST carries out the following responsibilities to improve the Federal Government's management and use of automatic data processing (ADP): develops Federal ADP standards; provides agencies with scientific and technological advisory services relating to ADP; undertakes necessary research in computer science and technology.

The Committee believes the activities of ICST to develop standards for high level programming languages, software, computer system and network interfaces, computer security, and database management are vital to the productivity and cost effectiveness of the Federal Government as well as private sector ADP users and manufacturers. ICST participation in developing international standards is essential to reducing barriers to the flow of information and to trade. The bill includes $12,700,000 for work in computer science and technology which would permit support for the development of international standards and research in support of standards development.

CORE RESEARCH PROGRAM FOR INNOVATION AND PRODUCTIVITY

The National Bureau of Standards has unique capabilities to assist in stimulating innovation in industry to sustain economic growth and improve productivity. The bill would authorize a $475,000 increase in the Core Research Program for Innovation and Productivity which is aimed at the advancement, through research and development, of selected generic technologies.

The Committee's hearings on technological innovation over the past three years have emphasized repeatedly: (1) the direct and significant relationship between R & D investment and technological innovation; (2) the importance of technological innovation in fostering increased productivity, employment opportunities, economic growth, and favorable trade balances; and (3) the national, social and economic importance of technological innovation and enhanced productivity in combatting inflation.

In light of these findings, the Committee reaffirms the value of the Bureau's Core Research Program, which was established two years ago at the request of Congress. The bill would authorize $11,586,000 for this program. Research areas, identified by the Committee as being of sufficient national technological importance to merit inclusion in this program, include: (1) Automated Manufacturing Research; (2) Discrete Process Technology—Robotics; (3) Very Large Scale Integrated Circuits; (4) Continuous Process Technology; and (5) High Performance Materials Processes.

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TECHNICAL COMPETENCE FUND

In order to insure that the Bureau maintains and improves upon the underlying knowledge and skills necessary to meet the responsibilities delegated to it in the enabling legislation, additional legislative mandates, and administrative directives, research is supported from the Technical Competence Fund. These research projects (most are basic in nature) are of a long-term or theoretical nature. The decision to go ahead with a project is based on the potential that project holds for enhancing the Bureau's expertise in measurement science and technology. With this research base, the Committee believes the Bureau is in a better position to continue to respond effectively to emerging issues, and thus, the bill would authorize $8,986,000 for this purpose.

FIRE RESEARCH CENTER

The Center for Fire Research (CFR) was established by the Congress in 1974 to conduct research on the prevention and control of fires. In past years, the Center's work was closely coordinated with the broader research and development effort of the U.S. Fire Administration, a part of the Federal Emergency Management Agency (FEMA). For FY 1983 the Administration has not proposed funding for the U.S. Fire Administration. Since, in fact, about 70% of the CFR's monies came via pass-through funding from the Fire Administration, the full amount of these funds, or $3.6 million, has been added to this line item of the National Bureau of Standards. Along with the Committee, the Administration has also proposed this formal transfer of monies from FEMA to the Bureau. Thus, the bill would authorize a total of $4,991,000 for FY 1983 for fire research.

CENTRAL TECHNICAL SUPPORT

The bill would authorize $14,324,000 for Central Technical Support. Included in this line item are funds for the Central Planning Office, the Research Associate Program, and a Scientific Computing advisory service. Also included are $3.7 million for FY 1983 for the Bureau to continue their progress in augmenting existing NBS computing facilities as well as $5.4 million for Transfer to the Working Capital Fund, and $429,000 for facilities Modification. About $6 million of Central Technical Support monies are for the purchase or lease of capital equipment and facilities to which the Bureau and the Committee attach particular importance.

FLOORS AND CEILINGS

The Committee identified a small number of NBS program activities which were judged to be of exceptional importance. For these activities the bill would provide minimum funding levels. For the line item "Transfers to Working Capital Fund," a funding ceiling would be stipulated.

1. OFFICE OF WEIGHTS AND MEASURES

The Office of Weights and Measures provides support to the National Conference of Weights and Measures, which is the national organization of state and local weights and measures officials. While NBS has no enforcement role, it is responsible for providing standards and other technical support to the states. The growing use of electronics in measuring equipment and the increased use of the Metric System has made urgent the need for technical training of local officials. The Committee bill would provide a minimum funding level of $1.2 million for this in FY 1983, an increase of $370,000 over FY 1982, which would support the development of a Standardized Weights and Measures Training Program, estimated to cost $150,000, and a Type Approved Program for instruments used in legal metrology, estimated at $220,000 for use by the states.

2. EARTHQUAKE HAZARDS ENGINEERING

Building research and the development of construction standards aimed at increasing the resistance to earthquakes has been performed by the NBS since 1978. The bill would provide for a minimum funding level of $500,000 for FY 1983, an increase of $25,000 over FY 1982. In addition to this sum, approximately $200,000 is expected to be made available to the NBS from the Federal Emergency Management Agency (FEMA).

3. MEASUREMENT STANDARDS FOR THE HANDICAPPED

In the past, NBS has carried out work in several areas related to the needs of the disabled. Such areas include building technology, fire research, product performance testing, materials reliability and durability, and computer-aided control and communication of standards activities. The Administration's budget for FY 1983 does not include specific funding information for this program. In FY 1981, the Bureau spent $971,000 on this activity. In FY 1982, the Bureau is devoting about $820,000 of its resources for this purpose. The Committee believes that NBS has the expertise to make important contributions in this area and has included in the bill a $1 million minimum for FY 1983.

4. COMPUTER SCIENCE AND TECHNOLOGY

NBS's Institute for Computer Service and Technology (ICST) follows a comprehensive plan for the development of federal automatic data processing standards and guidelines. The timely development of needed Federal standards is critical to the effective use of this rapidly emerging technology by the Federal government. Furthermore, ICST participation in developing international standards is essential to maintaining a U.S. competitive position in international trade. These important functions are dependent on adequate resources for supportive research and U.S. participation in international meetings. ICST has demonstrated the necessary expertise to make significant contributions in these areas. Therefore, the Committee has included in the bill a $10 million minimum for FY 1983 to ensure that these activities will be continued at a high level of quality and in a timely fashion.

5. AUTOMATED MANUFACTURING RESEARCH FACILITY

This facility was designed and set up as directed by the Committee in the FY 1981 authorization to reduce technological barriers to successfully combining automation equipment from various manufacturers. While the larger, more sophisticated companies can perform some of this work, small-batch manufacturers often lack the technical capabilities and resources to solve these interface problems. The Committee feels that a continuing Federal effort is justified and the bill includes a funding floor of $3 million for the completion of the facility and projects for FY 1983.

6. DISCRETE PROCESS TECHNOLOGY: ROBOTICS

Programmable, flexible materials handlers, also known as industrial robots, will play a major role in the factory of the future. Standards for such devices must be developed to assure computer compatibility and interchangeability. This program will include research on intelligent vision systems, the development of hierarchical control strategies, interface standards and other related subjects needed for industrial advances in this field. Many feel that the Japanese are further along than the United States in the introduction of robots into the factories, though not in the technology of the robots themselves. The Committee has included a floor of $3.2 million for robotics-related research.

7. TRANSFERS TO WORKING CAPITAL FUND

A funding ceiling of $5,386,000 is in the bill for Transfers to Working Capital Fund. As in past years, these funds would be available for investment in general equipment and standard reference material production. Of the total, $3,149,000 is to maintain the replacement value of the present general equipment inventory. These funds will permit the Bureau to replace equipment where there is a critical need to take advantage of automation and other developing technologies that lead to more efficient laboratory operations.

NATIONAL TECHNICAL INFORMATION SERVICE

The bill would authorize $1.9 million to the National Technical Information Service (NTIS) for the purpose of increasing innovation and productivity through an enhanced dissemination of technical information. The Committee believes that information concerning Federal technological, scientific, economic, and engineering research should be accessible to business, industry, government, and other interested individuals and organizations. This program has the opportunity to improve the economic health and growth rate of U.S. firms as well as to increase the world competitive position of American industry and development. The Committee encourages NTIS to provide and promote a full array of services and products regarding research from Federal laboratories and R&D centers to U.S. industries, as well as from foreign technological and scientific advances.

OFFICE OF PRODUCTIVITY, TECHNOLOGY AND INNOVATION

The bill would authorize $1.9 million for the Office of Productivity, Technology and Innovation (OPTI). This Office serves as the focal point for efforts to develop policies and cooperative activities between government and industry to find solutions to the nation's problems of technological innovativeness and industrial productivity. The sum authorized would permit OPTI to move forward with programs of policy studies, the coordination of Federal patent policy, and the voluntary conversion to the metric system.

OPTI also is responsible for implementing the Stevenson-Wydler Technology Innovation Act of 1980 (P.L. 96-480 for which separate authorization exists. The Committee is recommending the appropriation of $5.0 million for OPTI to move forward with the establishment of the Office of Industrial Technology, the Joint Industry/University Centers for Industrial Technology, and the Center for the Utilization of Federal Technology.

3. ADDITIONAL PROVISIONS OF THE BILL

Excess Foreign Currency (Sec. 3)

The bill would authorize $500,000 in excess foreign currencies for expenses of the Bureau incurred outside the United States.

Salary Adjustments (Sec. 6)

The bill would provide that if salary adjustments are required, they be proportionately absorbed if supplemental appropriations do not provide the necessary salary supplements.

Availability of Appropriations (Sec. 7)

A provision specifying that funds appropriated under this Act shall remain available as specified in the Appropriations Act is included in the bill.

Transfer of Funds (Sec. 8)

If transfer of funds amounting to more than 10 percent between the program categories reflected in the line items of the bill are essential to the operation of the National Bureau of Standards, notification should be made to the House and Senate authorizing committees.

Activities Performed for Other Agencies (Sec. 9)

The bill specifies that the Secretary of Commerce shall charge for services performed by the Bureau either at the request of another government agency, or to comply with any statute containing a provision which specifically names the Secretary or the Bureau to perform certain activities with, for, or on behalf of another government agency. This section also would permit the Secretary to waive any charge where the service rendered by the Bureau is such that the Bureau will incur only nominal costs in performing it. It specifies that costs shall be determined in accordance with subsection 12(e) of the Organic Act (15 U.S.C. 278b(e)).

4. COMMITTEE VIEWS

In addition to the foregoing considerations and analysis which are reflected in the bill, the Committee directs the attention of the National Bureau of Standards, the Office of Productivity, Technology and Productivity, and the National Technical Information Service to the following Committee Views and, where appropriate, asks the agencies to take the required action.

Office of Weights and Measures

The Committee has concluded that the NBS has been giving insufficient attention to the needs of those who make use of standards and measurement technology beyond the walls of its superb laboratories. It recommends a strengthening of the Bureau's support for the important activities of weights and measures officers in state and local governments. From testimony during the hearings and letters, and statements submitted, it is evident that over the last 10 years the NBS has reduced the staff and resources supporting the National Conference of Weights and Measures, the voluntary organization of state and local weights and measures officials. This has occurred at a time when the national economy has grown rapidly and when significant advances in weights and measurement technologies used throughout that economy, such as, the growing use of microcircuitry in weighing devices and the gradual change to the Metric system, for example, in gasoline dispensing, have accelerated. Since 1970 the Bureau's organizational element principally responsible for supporting the National Conference of Weights and Measures, the Office of Weights and Measures, has experienced a staff reduction from 29 to 11. This erosion of staff has become so serious that the 66th annual meeting of the NCWM in 1981 felt called upon to address in a formal resolution "this indifference and lack of adequate support by the NBS to the Office of Weights and Measures." As a result, important activities, such as standards traceability through laboratory auditing, and accuracy assurance through prototype testing have been weakened.

The needed protection for the seller and buyer, including the consumer, is endangered. While the Committee believes that strong support for the Bureau's research program must continue, it also believes that the research activities do not effectively serve the nation's interest if they are not accompanied by a vigorous delivery system which insures that the fruits of the research reach the users. The channeling of the Bureau's in-house measurement capabilities in a wide range of specialized areas to the user community must be a matter of continuous concern and attention by the Bureau's management. The lack of emphasis on this important function was further brought home to the Committee when it became evident that the Office of Weights and Measures was not separately identified in the Bureau's 109-page budget document submitted this year to the Congress. However, the Committee is encouraged by the attention which this matter has recently received personally from the Bureau's Director. The contemplated relocation of the Office of Weights and Measures into the Director's office, together with the budget increase from $800,000 to $1.2 million, which is included in this authorization bill, can well serve as a significant starting point for a rebuilding of this important function. In furtherance of that objective, the Committee directs the NBS to submit to the Committee no later than October 1, 1982 a report on the plan of work for the Office of Weights and Measures in fiscal year 1983 with projections for fiscal years 1984 and 1985.

OFFICE OF PRODUCT STANDARDS POLICY

The Committee views the Office of Product Standards Policy (OPSP) as a small but significant link essential for the success of the voluntary standards effort in the United States. When plans for the transfer of the OPSP from the Office of the Assistant Secretary of Commerce to the National Bureau of Standards were announced, the Committee received a number of expressions of concern from interested organizations and individuals. These concerns centered on the viability of the OPSP, an organization dependent for its effectiveness on extensive working relations with the private sector, within what was perceived as the potentially inhospitable environment of the National Bureau of Standards. Specifically, many felt that NBS's recent record of deemphasizing its close working relationship with standards making bodies and relevant firms in industry would make it difficult for OPSP to carry out its tasks. Concern was also expressed that a role for the Bureau in settings standards policy might interfere with its long-standing and active role in helping establish standards themselves, a role which the Bureau plays through the participation of dozens of NBS professional staff members in voluntary standards technical groups. The Committee has alerted the Secretary and the National Bureau of Standards Director to these concerns. The Department has decided to go forward with the transfer of OPSP to the NBS. The Committee, therefore, urges the NBS to give its full support and encouragement to the OPSP, with specific emphasis on the need for the NBS Director and his senior management team to support the Office in its work with both the NBS scientific staff and with the external community.

BALANCE BETWEEN INTERNAL/EXTERNAL ACTIVITIES AT THE NATIONAL BUREAU OF STANDARDS

The Committee has become aware during the last 12 months of an apparently widely held concern, throughout the Bureau's constituency in industry and in state and local government, about the Bureau's reduced interest in working closely with the users of NBS research results. The concern by many of these users is that, while NBS is doing a superb job of in-house research in both new and traditional areas of metrology, standards, and technology development, and is working closely with outside scientists in some areas, it is percieved by some as having deemphasized the close working relationship with outside practitioners and engineers who put those scientific results into practice. The Committee has seen some evidence of this in the reduced support for the National Conference on Weights and Measures. The user community's reaction to the transfer of the Office of Product Standards Policy appears to indicate that many in the standards and engineering community have reached the same conclusion. The Committee believes that the Bureau's continued success can only be assured if an adequate balance between internal R&D work and outreach to the engineering community exists, and urges NBS to give searching and long-term attention to this question.

COMPUTER SCIENCE AND TECHNOLOGY

The Committee reaffirms its belief that NBS has a direct role not only in standards setting for the rapidly developing field of computer and information technology but also in assessing and influencing the broader national impact of this field. The Committee believes that the mission of the Institute for Computer Science and Technology (ICST) is essential to the development and implementation of a coherent National information policy and to the management of Federal information resources.

The Committee recognizes that legislation (H.R. 6006) was introduced on March 31, 1982 to fulfill the Administration's proposal to transfer ICST from NBS to the General Services Administration (GSA). The Committee strongly recommends that the Department of Commerce reconsider the proposed move and give consideration to maintaining the functions of ICST either within NBS or within the Department of Commerce. The Committee is concerned that the transfer of ICST to GSA will limit the role of ICST to that of developing standards for procurement purposes only. ICST should continue to work actively toward the development of standards such as high level programming languages, software, computer security, and high level network protocols. Furthermore, it is imperative for ICST to continue to represent U.S. interests in the international network protocols standards arena. The Committee is concerned that these activities would not be possible if ICST were transferred to GSA.

The Administration's FY 1983 budget proposal includes $7.1 million in the GSA budget for ICST. However, until such time as legislation is enacted which transfers ICST from NBS, the Committee will continue to authorize ICST within the authorizing appropriations for NBS. It is not the Committee's intent to authorize ICST in both the NBS and GSA budgets.

The bill includes $12.7 million for work in computer science and technology which would permit support for the development of international standards and research in support of standards development. The Committee recommends that NBS develop a long-range strategy for achieving a balanced program for ICST. Consideration should be given to placing increased emphasis on technical advisory services and research.

The Committee understands that ICST has, in previous years, received approximately $700,000 from NBS competence funds and that $200,000 has been allocated in FY 1982 on a one-time basis to phase out ICST projects supported by competence funding. The Committee belives that ICST competence funded projects have made a significant contribution to the ICST mission and are necessary to maintain staff competence for both advisory services and ADP standards activities. Therefore, the Committee directs NBS to provide ICST competence

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funding at a minimal annual effort of $700,000 for FY 1982 and to continue to provide ICST reasonable competence funding in succeeding fiscal years in which ICST is authorized through NBS. Likewise, the Committee expects NBS to continue to include ICST in the allocation of general NBS operating funds.

MEASUREMENT STANDARDS FOR THE HANDICAPPED

The Committee expects the National Bureau of Standards to continue to provide measurement technology and performance standards as they relate to devices and facilities unique to the disabled.

In the past, NBS has carried out work in several areas related to the needs of the disabled such as building technology, fire research, product performance testing, materials reliability and durability, computer-aided control and communications, and standards activities. There are two areas, in particular, where the Bureau is making and can make significant contributions: (1) in analyzing and providing the basic physical, chemical, and engineering data and understanding for the modification of environments in which disabled people live and work; and (2) in providing physical science and engineering foundations for the development and evaluation of devices or processes that help the disabled. The Bureau works in cooperation with other agencies to provide their special expertise in handicapped research.

The Committee believes that the Bureau, through its expertise, can mabe important contributions in the development of technological solutions for problems of the handicapped.

LONG-RANGE PLANNING

The Committee was encouraged by the establishment, in 1979, of a Planning Office for longer range, central planning activities at the NBS. At the previous authorization hearings, the Committee heard testimony from both the NBS Director and the head of the NBS Planning Office about the functions and utility of the planning activities for the Bureau. During the balance of the decade the conditions under which the NBS will function will continue to change. The external environment will see rapid technological change and American industry will be under pressure to meet domestic and foreign competition. Internally, the role of NBS within the Department of Commerce and within the Federal Government will continue to evolve. The Bureau's own programs and staff will generate their own needs and will themselves have to adapt to all of these factors. In those circumstances, the need for careful planning, in close concert with the Bureau's Director and senior management, will continue to be of the greatest importance. The Committee applauds the efforts already made in this area through its Planning Office, and urges the NBS to continue to make this significant effort to look beyond the annual budget-authorization-appropriations cycle to insure that it is prepared to meet the needs and challenges of future years.

FORMAT OF THE BUREAU'S BUDGET REQUEST

For several years, the Committee's analysis of the Bureau's budget and program descriptions and budget proposals has been more difficult than it needs to be due to the Bureau's persistence in presenting a different line-item breakdown than that contained in the Committee authorizing legislation. One difficulty in working with a three line item budget (Measurement Research and Standards, Engineering Measurement and Standards, and Central Technical Support) is that several of the Bureau's programs which are of key concern to the Committee and the Congress are obscured. These include the Core Research Program for Innovation and Productivity, the Technical Competence Fund, and the Fire Research Center. As in the budget which was authorized and appropriated for FY 1981 and FY 1982, this year's authorization bill includes specific line-items for these programs. The Committee does note that in its budget presentation to the Committee staff, the Bureau makes an attempt to reconcile these format differences. These attempts, however, are not satisfactory, and the Committee directs the Bureau to alter its formal budget presentation for FY 1984 and subsequent year so that it corresponds directly to the budget line item categories adopted in the authorizing legislation.

OFFICE OF PRODUCTIVITY, TECHNOLOGY AND INNOVATION

The Committee has long focused attention on the comparative lag of technological innovation in the United States. The Office of Productivity, Technology and Innovation (OPTI) of the Commerce Department occupies a strategic position within the federal government with respect to this issue. It has the potential for making a significant and perhaps critical contribution toward the solution of this problem. As such, OPTI has the continued support of the Committee. The decision by the Secretary of Commerce and the Administration, after a thorough review, to retain the Office of Assistant Secretary of Commerce for Productivity, Technology and Innovation, and appoint a distinguished industrial research administrator to this position is applauded by the Committee. The proposed strengthening of OPTI's staff should permit it to develop the policy initiatives for innovation and productivity which are urgently needed. However, the Committee is concerned about OPTI's current deemphasis on the federal government's role in technology development. The Committee shares the view that the bulk of successful innovation in the many fields of technology must necessarily originate in and be brought to fruition by the private sector. But for a significant group of technologies, little incentive exists for the private sector to invest in research and development, a view which is embodied in the language and intent of the Stevenson-Wydler Technology Innovation Act of 1980, Public Law 96–480. This Act provides for a number of modest but significant initiatives. This year the Administration has redirected the emphasis of the Office of Productivity, Technology and Innovation away from stimulating technology and innovation development and toward the economic and human resource elements of the productivity equation. The Committee is concerned with this redirection in light of OPTI's key implementing role for the Stevenson-Wydler Act. The Commitee notes that adequate authorization already exists to fund the Stevenson-Wydler programs, and strongly encourages the Administration, and particularly OPTI, to obtain and expend these funds in accordance with the intent of the Congress. The Committee has recommended that $5 million be appropriated to move forward with these initiatives and urges the Secretary and the Director of OPTI to give their support to these activities. The Committee requests that OPTI submit a report to the Committee by December 30, 1982, addressing OPTI's progress in implementing Public Law 96–480, particularly sections 5, 6 and 11.

METRIC CONVERSION

The Committee has long had a strong interest in the voluntary conversion to the Metric system of weights and measures in the United States. The enactment of the Metric Study Act of 1968 and the Metric Conversion Act of 1975 were aimed at providing federal encouragement and assistance for Metric conversion. The Administration has proposed discontinuing the 17-member U.S. Metric Board, which was established by the 1975 Act, and giving to the Office of Productivity, Technology and Innovation in the Commerce Department a continued but sharply reduced role in Metric conversion. The Committee has, with some reluctance, concluded that this approach is acceptable at this time. However, to permit the Committee to review the content and thrust of the OPTI metric effort, it directs the Director of OPTI to submit to the Committee, no later than September 30, 1982, a Plan of Action for the Department's Metric activities for the next three years.

NATIONAL TECHNICAL INFORMATION SERVICE

The Committee recognizes that the operations of the Smithsonian Science Information Exchange (SSIE) were terminated on October 30, 1981. The Committee believes that the functions of SSIE to disseminate information on research in progress by federal agencies are important to the management and application of the nation's resources for science and technology. Therefore, the Committee encourages NTIS to develop cost-effective means for absorbing and maintaining the functions of the SSIE.

5. EXPLANATION OF BUDGET CATEGORIES

The detailed program activities and subactivities that would be performed under the proposed budget levels in the bill are described in this section.

NATIONAL BUREAU OF STANDARDS

1. MEASUREMENT RESEARCH AND STANDARDS (SEC. 2(a)(1)) $50, 389, 000

This activity encompasses a broad program of research in measurements and standards being performed by the National Measurement Laboratory. The subactivities include Physical and Chemical Measurements and Standards, Materials and Thermodynamic Measurements and Standards, a Measurement Assurance Program, and an Applied Measurement Program. A description of these subactivities follows.

PHYSICAL AND CHEMICAL MEASUREMENTS AND STANDARDS......... $20, 856, 000

The goals of this subactivity are to (1) fulfill the mandated responsibility of the NBS Organic Act (P.L. 56–177) for the "custody, maintenance, and development (and dissemination) of the national standards of measurement;" and (2) provide the Nation with physical and

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chemical standards, measurement techniques, reference materials, and critical data needed as a basis for uniform measurements.

Objectives:

Maintain, disseminate, and improve the present standards for temperature, pressure, mass, length, time, frequency, and electrical quantities that are required in industry, commerce, medicine, transportation, government, and scientific research.

Maintain, disseminate, and improve standards and measurement techniques for radiometry and photometry required to achieve the accuracy, uniformity, and efficiency of radiation measurements.

Develop quantitative understanding of the interactions with matter of electron, neutron, and photon radiations necessary for design and utilization of radiation sources, development of radiation standards and detectors, and applications of radiation to national problems, which will enable the safe and effective use of these radiations in areas such as nuclear energy, medical diagnostics and therapy, industrial processing, and radiation protection to the public.

Develop capability for measuring high temperatures and particle densities needed in plasma research and applications in industrial coating of high temperature ceramics, electrical power switches, solar studies, and fusion energy devices.

Develop compositional measurement methods and standards for qualitative and quantitative chemical analyses of metals, other inorganic species, gas mixtures, and organic compounds required by industry for economical quality control, to provide a sound technical basis for monitoring of chemical species, by medical laboratories for efficient and reliable health care delivery, by scientific research institutions, and by standards organizations.

Disseminate a uniform measurement system for physical and chemical measurement quantities in the U.S. and represent the Nation in international agreements to maintain a consistent worldwide system of physical measurements.

Fundamental Physical Measurements and Standards—$9,947,000

This program maintains and improves standards for the physical units of time and frequency, temperature, pressure, length, mass, and the volt and ohm. Measurements and calibrations made against these standards are disseminated to the point of use through transfer standards or other appropriate mechanisms. Virtually all types of industrial activities, research and development work in science and medicine, and the national defense system receive support from this program. A variety of consultation and training services for specific technical areas are offered to enhance the efficiency of the measurement system. Fundamental physical constants (such as the speed of light) affecting broad areas of scientific endeavor and industrial activity are measured and evaluated using the staff expertise and instrumentation available at NBS.

A recent accomplishment in this program has been the completion of thermodynamic measurements of temperature which permit extension of the International Practical Temperature Scale to the low temperature range. These measurements are used in superconductivity measurements for applications such as magnetic fusion and high efficiency

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power transmission lines. NBS has also developed the capability to make state-of-the- art measurements of mass (2 parts per billion) in order to support calibration services of commercial and Government laboratories. In addition, the performance of Zeeman-stabilized lasers as an economical interferometric light source for precision length measurements in industrial applications has been evaluated.

Planned accomplishments in fiscal year 1983 include the following:

Complete the proposed text of a replacement International Practical Temperature Scale for review by the International Consultative Committee for Thermometry.

Complete the accurate frequency measurement of three lasers stabilized on lines in the visible spectrum of iodine to provide for the practical realization of an internationally proposed redefinition of the meter.

Complete the preliminary design specifications for construction of the next generation of the primary time and frequency standard, designated NBS-7, capable of an order of magnitude accuracy improvement to one part in 10^{14}.

Redetermine the NBS "as maintained" units of capacitance and resistance to an accuracy of 1 part in 100 million, to ensure that the NBS units are consistent with the internationally accepted system and to provide calibration services to industry with the accuracy required.

Radiation Measurements and Standards—$8,590,000

This program conducts basic and applied research in nuclear radiation physics, optical radiation physics, plasma physics, ultraviolet physics, electron physics, and nuclear structure in order to improve the understanding of the interaction radiation with matter, and provides radiation measurement services and critical data for such diverse groups as designers of nuclear power plants and the utility companies operating them, agencies responsible for nuclear safeguards, hospitals, and scientists. NBS is developing standards based on this research for radiography, dosimetry, radio activity, gamma and x-rays, neutron beams and fields, and plasmas, as well as publishing critical data on atomic transitions.

A recent accomplishment in this program has been the determination of neutron production rates for the three NBS standard fast-neutron sources to an accuracy of one to three percent in order to improve neutron dosimetry calibrations and to provide more fuel efficient operation of existing nuclear power reactors. This program has also determined the ionization-to-dose conversion factor needed in the NBS absorbed-dose standards program for high-energy electrons and gamma rays in order to improve the accuracy with which existing calibrations of high-energy electron beams can be made. In addition, this program has evaluated high accuracy silicon cells, corrected for visual response, as substitutes for lamps as photometric standards.

Planned accomplishments in fiscal year 1983 include the following:

Complete American Society for Testing and Materials (ASTM) standards required for surveillance radiation dosimetry of U.S. electric power reactor pressure vessels to enhance the useful lifetime of these vessels.

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Determine the accurate yield of chemical dosimeters required for photon and electron radiation therapy of cancer.

Complete the feasibility study of the use of interference-filtered silicon photodiodes to achieve the needed accuracy for the normalization of standard calibration lamps used in communications and the lighting industries.

Analytical Chemical Measurements and Standards—$2,319,000

This program conducts basic and applied research that leads to the development of techniques for high accuracy chemical analysis in support of many Federal programs including environmental pollution, toxic substances and health services, as well as the chemical, clinical, instrument manufacturing, and metals producing industries. Important decisions concerning the medical treatment of people or the abatement of pollution are often based on chemical analysis, and the reliability of these analyses assumes great significance both in terms of personal well-being and cost. In addition to developing new analytical techniques, NBS also provides the means to assess their reliability.

This program has recently improved the reproducibility of laser-enhanced ionization in flames by a factor of ten, which greatly enhances its use in analytical determinations. Another accomplishment has been the development of methodology for accurate acidity (pH) measurements in solutions at low ionic strengths such as acid rain and fresh lake water. In addition, this program has developed optoacoustic spectroscopy methods to measure trace gas concentrations required for pollution abatement.

Planned accomplishments in fiscal year 1983 include the following:

Develop analytical methodology for the quantification of toxic organic vapors (perchlorethylene, vinyl chloride) at less than part per million level for application in industrial hygiene.

Investigate the potential of negative chemical ionization mass spectrometry for the quantification of trace level nitrogen-containing aromatic hydrocarbons, such as aza-arene compounds, which are frequently toxic and representative of a class highly suspected to be carcinogens.

Develop analytical methodology to identify and quantify nutritionally essential and potentially toxic trace metals utilizing chromatographic separations in conjunction with metal-specific spectrometric detectors.

MATERIALS AND THERMODYNAMIC MEASUREMENT AND STANDARDS----- $19,016,000

The goals of this subactivity are to (1) provide for uniform and accurate measurements, standards, and data for materials and chemical systems; (2) define and describe the properties and performance of materials and the behavior of complex chemical systems; and (3) develop a fundamental understanding of materials processing and of chemical processes to promote technical innovation and improve industrial productivity.

Objectives:

Develop measurement methods, standards, and data to characterize the structure, properties, and behavior of metals, polymers, ceramics, and glasses in order to improve the control of processes tailoring these materials for specific end uses and to improve the predictions about the performance of such materials in service.

Provide the scientific basis for greater efficiency and quality control in the production of existing materials and for the development of innovative materials to be used for new products and technologies, thereby increasing productivity in U.S. industry.

Characterize the basic mechanisms that limit the durability of materials in service and provide test methods, standards, and data to improve materials performance and durability, thereby reducing economic costs (which are in excess of $100 billion per year) and threats to public safety that result from the deterioration and unexpected failure of materials.

Determine atomic, molecular and thermophysical properties and data required for the design and optimization of chemical and other manufacturing processes, for new applications in energy conversion, for science, and for new technologies.

Develop state-of-the-art surface, thermodynamic, molecular, and kinetic processes measurement techniques and standards, and compile and evaluate essential physical and chemical data in order to reduce the barriers to technological innovation in the chemical and other manufacturing industries.

Provide standards dealing with chemicals and materials and the measurement basis that contributes to improved productivity, public safety, and equity in the marketplace.

Materials Science—$14,740,000

This program has three complementary components: Transformation Science, Structure/Properties Science, and Durability Science. Transformation Science provides measurement technology and basic scientific information relating processing variables and materials performance. This information is required for development and production of primary materials and manufactured products, and it supports the development of innovative materials and new high performance materials, improvements in manufacturing processes, and advance in materials design. Important variables such as pressure, temperature, and mechanical stresses are studied to provide a basis for optimizing the production of desired internal structures and other materials properties. This information is used, for example, in processing bulk materials into forms suitable for use in products.

Structure/Properties Science undertakes experimental and theoretical investigations of technologically promising and scientifically important materials to develop and provide key data and correlations between internal structure and properties that are used to design products with optimum performance characteristics.

Durability Science investigates key materials degradation mechanisms, identifies ways to control or retard them, and develops predictive methods for maximizing performance and lifetime in service. The major emphasis in the area of durability is the study of localized corrosion (the major uncontrolled type of corrosion) and the fracture mechanics of commercially important alloys, especially steels and aluminum alloys used in major structural applications such as bridges, pipelines, ships, and offshore structures. The NBS reactor, maintained and operated in this program, is a unique experimental facility which contributes broadly to this program and to a wide variety of other NBS programs.

This program enhances the effective utilization of materials by providing the measurement services needed for the optimization of component and structure design, materials selection, new materials development, processing and recycling, and the accuracy of lifetime prediction. The expanding application of materials in our technologically based society requires more precise, accurate, and sophisticated measurement techniques to characterize important new materials. These applications also require better materials specifications and data for the wide variety of materials currently in use. Materials standards and reliable measurements are needed to monitor performance characteristics and ensure equity in commerce. Increases in the productivity and efficiency of materials processes are needed to improve the competitive position of the U.S. in world trade. This requires the use of lower cost raw materials, more efficient processing, the reduction of process costs (including more efficient use of energy), and the reduction of loss through materials degradation and failure.

In the area of transformation science, this program has recently completed the validation of new self-calibrating procedures for polymer molecular weight measurements using gel permeation chromatography. Alloy stability models, instrumentation, and measurement technology with special attention to conditions under which metallic glasses may be formed have been developed in order to provide a scientific basis for the industrial use of these innovative materials. A unique experimental metals processing facility has been developed. A recent accomplishment in the area of structure/properties science has been the determination of the nature and number of new chemical groups formed during the mechanical deformation of polyethylene. This information will serve as a basis for design criteria to achieve high strength plastic materials leading to new structural applications and to all-polymeric composites. In addition, neutron inelastic scattering as an analytic method for detecting hydrogen in metals at the ten parts per million level has been established. This will aid in reducing economic losses and maintenance cost due to hydrogen embrittlement in steel and titanium. In the area of durability, methods have been evaluated for the identification and measurement of corrosion in pits, cracks, and crevices to provide measurement techniques for localized corrosion and thereby reduce economic losses from presently unavoidable corrosive degradation. This program has also completed the collection and evaluation of elevated temperature crack growth and fracture data on metals, leading to the establishment of improved codes and standards for structural metal applications.

Planned accomplishments in fiscal year 1983 include the following:

Develop relationships between elastic-plastic fracture parameters and applied strain for three dimensional flaws in steels (e.g. surface flaws) so that design curves, which are the basis for fitness of service codes, can be improved.

Complete fundamental microstructure measurements of magnetic clustering in spin-glass solids and relate these to novel magnetic properties of this new material structure configuration with potential uses in innovative electronic device technology using unique new NBS experimental capabilities for low angle and high resolution neutron scattering measurements.

Determine effects of microstructure and environment on fatigue performance of copper and steel alloys in wear applications to minimize costs of sudden failure in manufacturing machinery and ground transportation equipment.

Develop model for surface modifications of alloys with high energy sources, such as electron beams.

Develop high flux x-ray measurement system for real-time characterization of alloy microstructure to provide the fundamental science and measurement base for development of advanced alloys and innovative processing techniques.

Thermodynamic and Molecular Science—$4,276,000

This program deals primarily with the fundamental chemical processes, with chemical and physical properties of matter, and with how these processes and properties change with temperature and pressure. These changes are important in a wide variety of applications, such as chemical and industrial manufacturing, in energy conversion processes, and in atmospheric reactions. Changes in physical and chemical properties are measured and studied at the atomic and molecular levels in order to correlate such data with technologically important bulk properties and processes significant in the handling and production of chemicals and energy. Successful correlations will lead to predictive equations for property and chemical process data for materials and mixtures, over ranges of pressure, temperature and composition, for which direct measurements are not available. These predictive equations will make it possible to provide data needed by industry for optimizing processes with respect to energy requirements and feedstock supply. The measurement methods, standards and data produced in this program are essential to many industries and government programs, especially in the safe handling of potentially hazardous chemical materials, in resource management for the production and use of refuse derived fuels, in defense for the development of laser and other weapons, in energy conservation for the design of more energy efficient processes and plants and in environmental pollution control to provide the scientific foundation for decisions concerning low-pollution reaction pathways, reasonable regulations and compliance demonstration. NBS research forms the basis for more application oriented programs of other Federal agencies.

This program has recently determined the role of chemical additives, such as alkali metals, in the production of methane over a model nickel catalyst in order to establish a basis for improving efficiencies in catalytic processes in industry. Another accomplishment has been the measurements of reaction rates of hydroxyl radicals with selected atmospheric constituents in order to determine the importance of these reactions in the fluorocarbon cycle affecting the Earth's ozone layer. In addition, this program has completed the formulation of the thermophysical properties of the important feedstock ethylene in order to assist industry in relating pressure and volume measurements with known amounts of this fluid during custody exchange and in computer controlled production processes.

Planned accomplishments in fiscal year 1983 include the following:

Apply techniques of vibrational spectroscopy to identify molecular fragments on catalytic surfaces and identify reaction mechanisms in order to provide data and models needed to improve industrial catalytic processes.

Complete the construction and testing of a heated shock tube for measuring the rate of oxidation reactions under severe conditions like those found in chemical production and combustion.

Use recently developed light scattering techniques to measure the viscosity of complex liquid mixtures. Viscosity is an important industrial process control parameter.

MEASUREMENT ASSISTANCE PROGRAM ---------------------------- $3, 448, 000

The goals of this program are to (1) provide an efficient measurement dissemination system that makes it possible for industry and government agencies at all levels to make uniform and accurate measurements, (2) assist in the development of measurement intensive voluntary standards in order to assure that the effectiveness and value of such standards in the domestic economy are not reduced by the lack of good measurement practice, and (3) cooperate with other governments in the formulation of international codes and standards and work to insure that international codes and standards are consistent with U.S. practices in the areas of measurement technology that may affect the competitive position of U.S. industry and trade.

Objectives:

Maintain and improve the national measurement system which facilitates uniform and accurate measurements needed in industry, science, and government for quality control and for the enforcement of, and compliance with, regulations for commerce, health, and safety in the marketplace. Support the system with training and consultation, as appropriate, and with participation in domestic and international standards development. Assist in organizing effective means of dissemination and develop methods for maintaining optimum statistical control of measurement systems.

Support an effective system of uniform weights and measurements, laws, regulations, device specifications, and performance criteria which provides government, industry, and commerce with a basis for compatibility of products leading to increased productivity and equity in trade, and which provides U.S. industry a competitive position in the world market through coordination with international standards and practices.

Provide guidance to state and local weights and measures jurisdictions and to industrial standards laboratories to maintain, upgrade, and evaluate laboratory metrology procedures and services.

Office of Weights and Measures—$1,200,000

NBS supports the National Conference of Weights and Measures, the organization of state weights and measures officials. The Office organizes the annual meeting of the National Conference, assists in publishing its publications, and insures the dissemination of information of interest to the members. Extensive collaboration with state weights and measures offices are carried out in order to provide the states with the means for making uniform and accurate measurements. In fiscal year 1983 the Office will initiate an effort to train state officials in the calibration and checking of measurement devices which employ new and more sophisticated technology such as microcircuits.

Measurement Assurance Program—$2,248,000

NBS measurement assurance services are used to assure the quality of measurements in commercial and government calibration laboratories. This program coordinates calibration services and tests (which are performed on a reimbursable basis) for several thousand transfer standards from industrial and government laboratories. The voluntary standard setting activities of this program assist professional organizations in the formulation of measurement standards documents which impact a broad spectrum of measurements. In the area of international standards, the primary effort is directed toward the formulation of measurement-related documentary standards that are in harmony with U.S. domestic standards, reflect U.S. industrial and commercial practices and enhance, rather than inhibit, the U.S. position in world markets. This program also provides for increasing the efficiency of dissemination methods for measurements requiring very high accuracy and/or close statistical control and traceability to national standards through the maintenance of Regional Measurement Assurance Programs (RMAP's).

This program has recently implemented a voluntary National Type Approval Program with participant and subscribing states and the Federal Grain Inspection Service (USDA) for the testing of new weighing and measuring devices, such as scales, gasoline pumps, and fuel oil truck meters. In addition, a draft of international recommendations on gas measurement and on devices for verifying materials testing machines and electronic weighing systems has been prepared for submission to the Organization for International Legal Metrology (OIML). A recent accomplishment in the RMAP area includes the implementation of an RMAP for microwave power for industrial laboratories which will increase the quality of the high accuracy measurements associated with telecommunications. Work has been initiated on measurement assurance techniques and necessary supporting documentation for a DC resistance RMAP similar to the successful RMAP which exists for DC voltage.

Planned accomplishments in fiscal year 1983 include the following:

Complete and distribute to the states the first audio-visual cassettes to be used for the training of state inspectors in pre-package product checking.

Prepare and submit for publication a Metrologist's Handbook for use by state metrology officials.

Assure measurement quality control and traceability to national standards for x-ray dosimetry in six intermediate laboratories by use of NBS RMAP services.

APPLIED MEASUREMENT PROGRAMS-- $7,069,000

The goals of this subactivity are to (1) respond to specific national needs and the long-term needs of industry for measurement and data services through the development and operation of multidisciplinary programs that optimize the use of NBS technical resources, (2) coordinate the planning and dissemination of results of these programs with users in industry, universities and other Federal agencies, and (3) continually assess developing national needs for measurement and

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data services in order to insure that new programs are developed in a timely fashion to address these needs and that existing programs adapt to meet these needs in an optimum fashion. The programs include: nondestructive evaluation, environmental measurements, standard reference materials, standard reference data, and recycled materials.

Objectives:

Develop standards, measurement methods, calibration services, and procedures which will enable improved nondestructive detection and characterization of defects, more reliable measurements of certain physical properties, and more dependable evaluations of the performance life of materials, components, structures, manufactured products, and assemblies in order to promote the enhanced utilization of nondestructive evaluation methodologies in industry and Government, to enhance the safety and quality of manufactured products, and to conserve material and energy during processing.

Develop methods for characterizing Standard Reference Materials (SRM's) and reference methods for use with SRM's that are important for quality control in manufacturing and materials accountability in commerce, for assuring proficiency and accuracy in testing laboratories, and for providing a uniform and reliable measurement basis for industry, science and technology.

Foster the rapid and effective application of scientific results in industry and commerce through the provision of critically evaluated reference data to scientists, engineers, and the general public as mandated by the Standard Reference Data Act (P.L. 90-396).

Nondestructive Evaluation (NDE)—$2,042,000

This program provides standards and calibration services for the nondestructive evaluation (NDE) methods most widely used by industry for detecting and characterizing flaws in materials, structures, components, and manufactured products which if undetected could lead to premature failure. These methods, and examples of their use, include: ultrasonic testing, which is used for inspection of electric power generation components and systems; radiography, for inspection of oil and gas pipeline welds; eddy current testing, for inspection of aircraft components and steam generator tubing; penetrant diagnostics, for flaw detection in pumps and valves; and magnetic particle testing, for inspection of wrought steel products. The program also develops standards and calibration services which will speed the adoption of new or improved NDE methods that offer enhanced quality assurance capabilities. Some of the new methods being addressed include leakage testing (very small leaks) for electronic packages; acoustic emission testing for continuous monitoring of bridges and wear-debris analysis, which is particularly useful for condition monitoring of machinery.

The development of new and improved measurement methods and standards by NBS will promote the conservation of materials, increase the safety and reliability of products, and increase the Nation's productivity. Product failures resulting from defects introduced during processing or manufacturing may be greatly reduced by eliminating defective materials before they are used to fabricate components and by testing components and products before they are sold and placed into service. This requires a quality assurance technology that is capable of economically assessing the condition of materials and determining whether they are suitable for their intended applications. In addition, the extended use of NDE techniques throughout industry for defect detection requires greater reliability and comparability of test methods.

This program has recently developed recommendations for measuring the magnetic flux leakage due to surface and near-surface discontinuities in ferromagnetic materials. This work will lead to more reliable detection of flaws and reduced failure rates in structural components such as railroad rails and wheels. An optical procedure for the measurement of surface roughness in materials and manufactured products has also been developed to facilitate manufacturing and assembly operations and to help reduce failures due to mechanisms such as fretting and wear. In addition, a comparative evaluation of radiographic image-quality indicators has been developed which will help to stimulate trade by providing a basis for compatibility between international requirements for radiographic inspections.

Planned accomplishments in fiscal year 1983 include the following:

Develop calibration procedures for acoustic emission testing to improve monitoring for structural systems such as airframes.

Recommend holographic interferometric measurement procedures so that small surface distortions that occur prior to failure in products such as tires can be detected more reliably.

Develop method for measuring the ratio of neutron and gamma radiation in neutron beams to assure adequate contrast in neutron radiographic detection of corrosion of metallic structures.

Standard Reference Materials (SRM's)—$1,358,000

This program determines the feasibility of producing new SRM's, assures that SRM's are available in a form to be effectively utilized by the scientific and industrial communities, conducts measurement technology transfer projects, and coordinates SRM activities with industrial trade associations, other government agencies, standards groups, and professional societies. Standard reference materials have been produced, certified, and issued by NBS since 1906 and provide a benchmark for calibration of instruments and measurement systems. SRM's help industrialists and technologists make effective use of materials through improved quality control over the production of goods. They also help assure equity in buyer-seller transactions, and assure the long-term adequacy and integrity of the measurement process. NBS issues approximately 40,000 SRM units each year to over 12,000 customers. Approximately 1,000 different SRM's are now stocked. Major categories of SRM's include ferrous and non-ferrous metals, glass, rubber, plastics, chemicals, nuclear materials and standards for the evaluation of the performance for computer and electronic systems. In addition to the industrial customers, major SRM users include Federal and state governments, universities, and nonprofit research establishments. These customers use SRM's in programs related to health, environmental protection, meterology, and industrial quality control. An example of the extensive use and importance of SRM's throughout our Nation is in steel production, where more than 90 percent of the steel produced in the U.S.

is quality-controlled using measurement assurance traceable to NBS' SRM's.

This program has recently completed the method development and feasibility studies for (1) a new series of particle sizing SRM's in the 1–100 micrometer range for quality control of powders used in preparation of metals, ceramics, rubbers, paints, and for blood cell counting applications; (2) long-lived mixed radionuclides for calibrating nuclear instrumentation used in materials and environmental monitoring for the nuclear industry; (3) inorganic and organic nutrients in powdered milk; (4) very high density magnetic computer tape for quality control of high capacity computer storage tapes; and (5) low density fiberglass for measuring thermal resistance of building materials to promote energy conservation.

In fiscal year 1983, $500,000 will be transferred to the WCF to capitalize research and developmental costs associated with specific SRM's so that a larger part of the costs can be recovered through sales. This is in addition to the production and certification costs of SRM's which are currently capitalized and recovered through sales. The sale prices of SRM's will be raised to reflect the higher portion of capitalized research and development costs. Since an average production batch of SRMs results in a five-year inventory, the amount capitalized will not be entirely recovered through sales until the fifth year of sales, or seven years after the initial investment. Continued appropriations for transfer to the WCF through fiscal year 1988 will be required to complement sales income so that the level of capitalized research costs could be continued at $500,000 per year.

Planned accomplishments in fiscal year 1983 include the following:

Complete comprehensive biochemical/biological stability study and reevaluate certification of previously issued biological SRM's.

Complete feasibility study for absolute layer thickness SRM for use in calibrating surface analyses important in such diverse industries as electronics and chemical processing.

Complete development of methods needed for high accuracy analysis of iodine in foods.

Standard Reference Data—$3,669,000

This program provides scientists and engineers with critically evaluated physical and chemical data needed for the solution of problems in research, development, and engineering design in industry, government, and academic laboratories. The work is carried out in several data evaluation centers, located within NBS and in university, industrial, and other government laboratories. These centers collect all reported measurements on materials of interest, subject the chemical and physical data to critical evaluation and analysis by experts, develop appropriate models to predict the properties of substances that have not been measured, test the predictions with additional measurements, and produce compilations of data suitable for general industrial, scientific and engineering use.

The average annual publication of tables and standard reference data by this program is now over 5,000 pages, covering typically 25 to 50 different subjects. The raw material for these tables consists of the 30,000 or more original reports and research papers from all parts of the world which are collected and analyzed each year. This aggregate collection is also used to answer the hundreds of requests for specific data which are addressed to NBS every year.

This program has recently completed a new evaluation of the fundamental physical constants for international scientific and technical use. These fundamental quantities serve as the primary input to a wide range of scientific calculations. In addition, tables of standard spectral wavelengths have been published for calibration of laser devices used for detection of atmospheric pollutants and for development of more efficient combustion processes.

Planned accomplishments in fiscal year 1983 include the following:

Install a fluid properties data base in an on-line computer network to provide immediate access by the private and public sectors to reliable data for engineering calculations.

Publish a critical evaluation of rate constant data describing elementary reactions in the atmosphere with application to the measurements of stratospheric ozone.

2. ENGINEERING MEASUREMENTS AND STANDARDS (SEC. 2(a)(2)) $21,012,000

This activity includes research and development work on Engineering Standards, on Safety and Performance Engineering, Signals and Systems Technology, Chemical Engineering Technology, Mechanical Engineering Metrology, and research in the Mathematical Sciences. A description of the activities in each subcategory follows.

ENGINEERING STANDARDS........ $1,848,000

The goal of this subactivity is to enable the U.S. to realize the full potential benefits of engineering standardization in meeting national needs in areas such as public health and safety, regulatory reform, energy utilization, defense, environmental protection, productivity, and international trade.

Objectives:

Increase the accuracy of testing services provided by public and private testing laboratories, and promote uniformity of test results.

Develop NBS standards, policies, guidelines; monitor NBS participation in external standards activities; operate standards management support systems so that NBS can achieve Federal policy objectives through cooperative interactions with private standards-writing bodies; and provide guidance to other Federal agencies to develop these same capabilities.

Contribute to the development, evaluation, and implementation of U.S. national standards testing and certification policy. Operate the national standards information service so as to be available to Federal, State, and local governments, as well as to private sector users, and provide a focal point for information concerning international standardization.

This program provides standards and testing laboratory evaluation services in four basic activities. First, this program serves as the national focal point for promoting high caliber performance of testing laboratories participating in a voluntary accreditation program; to do so, NBS develops testing laboratory performance criteria, establishes examination methodology, qualifies examiners, makes on-site laboratory examinations, and provides recommendations on accreditation to the Secretary of Commerce. Second, the program operates the National Center for Standards and Certification Information which responds to approximately 7,000 inquiries, from business (50 percent), NBS and other agencies (30 percent), consumers, students, and others (20 percent), utilizing a nationally unique reference collection consisting of more than 260,000 standards, specifications, codes, and test methods issued by the U.S., foreign, and international standards-writing organizations. Third, the program provides overall NBS management, planning, policy development, and coordination of domestic engineering standards development, information, and impact analysis. The program includes the Standards Assistance and Management Information activity which provides data about domestic and international standards committee participation by NBS staff members. Finally, NBS has been assigned Departmental responsibility for implementing parts of the Trade Agreements Act of 1979 and OMB Circular A–119 concerned with overcoming trade barrier of standards and encouraging Federal participation in the development of standards by the private sector, respectively.

Testing laboratories perform an essential service in the national engineering standards system and are becoming increasingly important in supporting U.S. industries in giving acceptance of their goods in international trade. They provide assurance that products, including materials, components, and systems, meet the criteria stated in engineering and product standards. Several thousand testing laboratories exist in the U.S. as independent business entities, as governmental establishments, and within the corporate structure of U.S. industries. These organizations face new challenges which require improved methods for assuring their clients of the high quality of their testing services. The technical services provided by NBS are vital to the viability of the testing industry and the credibility of the National Voluntary Laboratory Accreditation Program.

The public sector and private industry require up-to-date information on standards. Domestic firms are seeking foreign marketing opportunities and need to know of relevant foreign standards. In all cases, efficiency of production, competition, and distribution are dependent on accurate, quick-response information on domestic and international standards. The NBS National Center for Standards and Certification Information is recognized for providing this information. Its operation greatly enhances the standards information acquisition efforts of domestic industry and serves as the U.S. Government's response to meet Trade Act obligations.

Recent accomplishments in the program include: agreement on international guidelines to be used for accrediting laboratories; the development of criteria and operation of domestic programs for laboratory accreditation for thermal insulation, carpet, and electrical calibration equipment; implementation of operational procedures for U.S. participation in the International Organization for Standardization Information Network (ISONET); and initiation of an inquiry service to provide the Secretariat for the General Agreement on Tariffs and Trade (GATT) with notification of proposed U.S. regulations on standards and certification and receive counterpart foreign notices as part of the requirements of the Trade Agreements Act of 1979.

Planned accomplishments for fiscal year 1983 include the following:

Establish basis with foreign countries for reciprocity on accreditation of laboratories and acceptance of test data.

Develop procedures leading to reimbursable service for translation of proposed foreign regulations as part of expanded technical support of U.S. exporters.

Provide guidance to other agencies to complete their development phase in implementing systems for monitoring agency participation in standards activities as directed by OMB.

SAFETY AND PERFORMANCE ENGINEERING RESEARCH------------------ $4,044,000

The goal of this subactivity is to remove technological or market barriers and thereby increase the productivity and safety of the building construction industry. This will be done by providing the technical basis for voluntary standards, building codes and specifications, through development of improved measurement techniques, test methods, and technical data that are not available from other sources.

Objectives:

Develop technical bases for improving building codes and specifications to reduce losses in earthquakes, extreme winds, and construction accidents.

Develop and validate a physical model that describes the mechanical properties of maturing concrets as a function of its curing conditions and composition and produce evaluation methods for assessing in-place strength of curing concrete.

Develop test procedures, predictive techniques, and measurement methods required for the adoption of cost effective new or innovative building materials and components, and building systems and equipment into conventional construction.

Develop test methods for thermal insulation materials, components, and systems required for voluntary standards, building codes, and specifications.

Develop simulation models and testing, and evaluation procedures for innovative thermal equipment and systems for inclusion in voluntary standards, codes, and specifications.

Building Research—$3,544,000

In fiscal year 1982, the Building Research program realigned its programatic thrusts so that the areas of building accessibility, human interaction with the building, and rehabilitation of existing buildings were deemphasized in favor of increased effort in the areas of measurements, test methods, and data relative to the physical and material aspects of buildings and their construction.

In fiscal year 1983, the Building Research program will provide research needed for codes and specifications that will reduce technological or market barriers by improving performance and reducing costs of structures and foundations; providing reliable means to assure that cost effective, innovative materials and components deliver their intended service lives; predicting the thermal, lighting, and acoustical properties of buildings for reduced design and construction costs; and providing test methods for the required performance for building equipment.

Specifically, NBS will provide the technical basis for voluntary standards which will lead to codes and specifications which, in turn,

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will increase benefits and reduce costs in construction by: (1) providing greater building reliability and durability; (2) reducing losses from high winds and earthquakes; and (3) reducing operating and maintenance costs. This program will produce measurement methods and test methods and data not available from other sources. Research activities will involve such construction engineering disciplines as materials, geotechnical construction, and structural engineering as well as building systems engineering disciplines in the areas of thermal, acoustical, illumination, mechanical, and electrical engineering. These will provide the basis for codes and specifications for design, construction and operation of building structures, foundations, and roofs, as well as heating, ventilating, air conditioning, lighting, plumbing, electrical, and building control systems.

The results of NBS work are used throughout the construction industry which in 1980 employed more than four million workers and accounted for over 10 percent of the U.S. gross national product. Investigations by NBS of structural collapses as part of the construction safety research program have led to improved test methods for determining the strength of structures. A uniform probability based load criteria developed in conjunction with the American National Standards Institute will be used for the design of all types of structures resulting in safer, more economical structures. Calibrated transfer specimens developed with a high precision guarded hot-plate capable of measuring thermal performance of thick insulation will result in substantial savings by insulation manufacturers. Presently, NBS, at the request of the Mayor of Kansas City and Congressional delegates from Missouri, is carrying out an investigation to determine the most probable cause of a building collapse that killed over 100 persons.

Recent accomplishments in this program include: acceptance of a methodology for service life prediction of building materials by the American Society for Testing and Materials for use as a standard; adoption of test methods and calculation procedures for determining seasonal thermal efficiency of furnaces, boilers, heat pumps and air conditioners as standards by the American Society for Heating, Refrigerating, and Air Conditioning Engineers; development of the method for measuring and rating steady-state room noise that provides the basis for the first ANSI standard on this subject; development of plumbing criteria for reduced size venting adopted by model codes; and development of soil classification methodology for improving construction excavation practices.

Planned accomplishments for fiscal year 1983 include the following:

Provide the technical basis for national standards that will enhance the economy and safety of construction operations.

Develop models for conductive and convective heat transfer in multi-room buildings.

Earthquake Hazards Engineering—$500,000

As part of the Building Research activity NBS will conduct research and development aimed at reducing losses to buildings resulting from earthquakes. This will involve development of draft seismic provisions for Federal buildings for the President's Earthquake Hazards Reduction Program.

Planned accomplishments during fiscal year 1983 include:

Develop models for predicting the failure mechanisms of masonry shear walls under seismic loadings, and

Develop rational criteria for safe and economical building design.

Provide measurement methods for and characterization of force (both static and dynamic), dimension, surface finish, machine errors, and other measurement based technology for production, in automated, manned, and combined man/machine modes.

Provide improved measurement science, critical data, and predictive methods which will enable the chemical process and related industries to calibrate their basic measurement processes to reduce the market barriers associated with the industry's current inability to predict process-dependent chemical properties.

SIGNALS AND SYSTEMS TECHNOLOGY ---------------------------------- $7,145,000

This program provides the basic measurement science needed by the electronics and electrical industry to address market barriers involving dimensional incompatibility and inability to test against specifications. This program conducts research and develops measurement and calibration methods, reference standards and artifacts, and supporting data, theory, and predictive models required for the removal of market barriers to the manufacture, application, and selling of electronic and electrical materials, components, and systems. Areas of emphasis are: fast signal acquisition, processing, and transmission; electrical systems; and electromagnetic interference.

The fast signal acquisition, processing and transmission efforts are directed at improved measurement and calibration methods for electronic instrumentation, antenna systems, microwave systems, optoelectronic systems, waveform characterizations, and cryoelectronic signal processing. Benefits include higher reliability of testing systems, more accurate and efficient signal processing equipment, a firmer measurement foundation for application of new technologies such as cryoelectronics, better utilization of communications technologies, and enhanced laser safety.

The electrical systems effort provides cost effective measurement technology for efficient and environmentally acceptable electric energy systems through improved accuracy in electrical energy measurements and better electrical measurements at high voltages. Benefits include better measurements of the amount of electric power sold and of the high voltages associated with the new transmission systems.

The electromagnetic interference effort provides the technical basis for understanding and control of the effects of interference phenomena through the development of basic measurement methods, and the associated theory, technology, and technical standards. This effort will provide a basis for improved understanding of the interference phenomena, and for efficient and accurate equipment design.

Planned accomplishments in fiscal year 1983 include the following:

Measure high voltage pulses up to 500 thousand volts having a duration down to 1 microsecond with an accuracy better than 0.5 percent.

Complete and document a special 6-port system to provide measurement services and calibrations for voltage, power attenuation, phase shift, and impedance in the range 30 kHz to 10 MHz.

Implement calibration services (for measurement assurance program) for selected characteristics of sources and detectors used in optical fiber communications systems.

Complete and document a national standard for measuring laser beam energy in the spectral range 0.4–15 micrometers to energy levels of 1 nanojoule.

CHEMICAL PROCESS TECHNOLOGY ---------------------------------- $2,551,000

This program provides the chemical process and associated industries with fundamental measurement science and critical data, that is not available from other sources, that enables these industries to calibrate their measurements relative to national standards and to obtain critical data that provide a key element of their technical base.

The measurement portion of this program places emphasis on the development of solid-fluid mixtures flow measurements and critical measurements such as flow stream composition, temperature, viscosity, and density. Many of the industrial measurements are made in harsh environments. This program is developing the measurement methods through which these industrial measurements can be made with the required accuracy. In addition, this program is developing calibration services for fluid measurements needed for diverse process control and equity in trade for liquids and gases. Also this program is developing measurement techniques and improved predictive methods for heat and mass transfer in chemical reactions.

The data portion of this program places emphasis on the development of critical thermophysical properties data for very key substances and predictive models that extend the measured data for a small set of measured substances to predictions of these data for many other substances. Thus, this program provides accurate data and theoretically based predictive techniques for characterizing critical materials and fluids to well defined uncertainties for the chemical industries.

Specific efforts will provide measurement technologies for determining material quantity used in American industries (beverage, auto, aircraft, chemical, petroleum, etc.). This will be accomplished by the development of measurement assurance programs for volume, density, and flowrate and will facilitate fair and equitable exchange of goods throughout commerce. By reducing the uncertainty in predicting thermophysical properties such as viscosity, thermal conductivity, phase equilibria, specific heat and density for critical hydrocarbon mixtures, costly chemical feedstocks and fuel waste will be reduced in the chemical process industries.

The chemical process industries have annual sales exceeding $160 billion. The U.S. chemical and petrochemical industries have a strong position in the international balance of trade. However, the U.S. share of world trade has dropped from 20 percent to 14 percent in the last ten years. This same sector of U.S. industry spends over 10 percent of gross sales on capital investments. The technical impacts of this program include: reduced capital costs for new plants; savings in raw materials for new and existing plants; reduced product energy content for new and existing plants; and reduced waste products and environmental pollution. These benefits, in turn, will have the following societal impacts: increased productivity and conservation of energy. Simultaneously, this program will provide equity in the marketplace as goods transferred in commerce are accurately measured.

Planned accomplishments for fiscal year 1983 include the following:

Prepare manual of custody transfer measurement methods for liquefied natural gas for use by buyer and seller in the international market.

Develop procedures for reproducible specific heat measurements on various coals and initiate similar measurement assurance efforts for thermal conductivity of coals.

Develop and test preliminary predictive models to describe mass transfer for both transient and steady state conditions.

Develop scientific basis, research facility and measurement techniques to detect solid phase fraction in solid liquid flows.

Develop viable fiber optic and thin film measurement techniques to obtain required accuracy in industrial process environments (at high temperatures in erosive/corrosive fluids).

MECHANICAL ENGINEERING METROLOGY---------------------------- $1,823,000

This program's objective is to improve measurement services associated with such manufacturing-related physical quantities as length, force, mass, surface finish, and ultrasonic flaw detection.

NBS will continue its ongoing program to support those manufacturing industries where nonautomated manufacturing and metrology are clearly economically and technically superior. Areas of emphasis will include length, mass, force optical metrology, acoustical metrology, and surface finish.

Planned accomplishments for fiscal year 1983 include:

Complete automation of NBS line scale laboratory permitting reduceion in unit cost of calibration of precision rulers or line scale, which are becoming the primary standard for length in American industry, relative to the national standard of length, i.e., the meter.

Demonstrate a new surface roughness measurement technique for the range of 0.1 to 1.0 micrometer using a light-scattering method.

MATHEMATICAL SCIENCES------------------------------------- $3,601,000

The goal of this program is to ensure that the most appropriate mathematical, computational and statistical procedures are available for use in NBS technical programs.

Objectives:

Provide and promote the use of effective statistical techniques for planning experiments and data collection programs, and for analyzing and interpreting results.

Provide and promote available or specially developed mathematical techniques and software for interpreting and quantitatively analyzing physical and engineering system models and their performance.

Facilitate the use of more efficient or effective scientific theory by providing software systems, processors, language, and algorithms, including scientific data base management systems, graphics and image processing systems, symbolic algebraic languages, and statistical and numerical computation and modeling languages.

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This program has a substantial impact on both the efficiency and productivity of all NBS programs as well as the quality of their output. This is achieved by: using statistics to optimize laboratory experimental design and to utilize laboratory experimental resources in the most cost-effective manner; minimizing duplication of effort by acquisition and development of mathematical, statistical, operations research, and scientific computing techniques common to the needs of different NBS programs; providing readily accessible mathematical and computing techniques which enable NBS physical scientists and engineers to focus more fully on program needs; and providing specialized statistical support for NBS calibration, standard reference materials certification, and test method development activities, which rely heavily on correct and fully documented statements of accuracy and precision. NBS mathematicians, having an understanding of the Bureau's work, are in a position to draw from the literature and from mathematicians at other organizations the mathematical methods that will most effectively serve the needs of individual programs. In addition, direct involvement with Bureau programs allows NBS mathematicians and statisticans to recognize needs common to many application areas and to develop or adapt tools or methods to meet these needs.

Examples of types of assistance provided by the mathematical sciences program to other NBS programs include: design of systems for automatic acquisition of laboratory data; statistical techniques for measurement assurance; probability-type models of safety factors for critical structures and components; and methods of modeling the design of facilities for fire safety.

Recent accomplishments in this program area include: development and implementation of algorithms for the graphic display of metal phase diagram slices taken from three component metal alloys; completion of software for analysis of multi-time-series phenomena for analyzing characteristics of international time standards; document research on nonlinear difference equations for use in solving partial differential equations which arise in many physical systems such as fluid flow; and testing and installing a new real-time operating system for NBS microprocessors which will increase the efficiency of data acquisition systems at NBS.

Planned accomplishments for fiscal year 1983 include:

Provide an accessible library of optimization codes for NBS users, including new developments from such computational techniques, nonlinear least squares, network-flow minimization, and non-serial optimization.

Provide versatile computational algorithms, which make computing with extended numerical precision routinely available to laboratory scientists.

Develop methods for random process modeling of correlated measurement errors, such as those which occur in automated experiments which are used for the maintenance and dissemination of electrical and frequency standards.

Report on a statistically based microstructure theory of fatigue mechanisms in metals and polymers.

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Develop and document computerized algebraic and data manipulation methods used in interactive graphics and in the analytical solution of nonlinear dynamical systems.

3. COMPUTER SCIENCE AND TECHNOLOGY (SEC. 2(a)(3)).. $12, 731, 000

The goals of this activity are to develop, issue and maintain standards and guidelines needed to achieve: (1) competitive and economic procurement of Federal computer systems, components and services; (2) life-cycle efficiency and effectiveness of Federal computer resource utilization; (3) portability of data, software and technical skills across computer systems; (4) protection of computer systems and networks against unauthorized access, manipulation or abuse; (5) reduction of waste, error and unnecessary duplication in the application of computer systems; and (6) increased productivity of the Federal work force.

The specific objectives are to:

Develop and maintain a comprehensive plan for the development of Federal automatic data processing (ADP) standards and guidelines.

Establish close communications with Federal agencies to determine needs for Federal standards and guidelines.

Conduct technology forecasts to anticipate future needs for Federal standards and guidelines.

Coordinate with and support voluntary standards-making organizations to assure timely, efficient and industry-compatible standards development.

Perform cost/benefit or other appropriate analyses of proposed standards to determine their impact.

Produce and test standards for Federal ADP systems.

Advise the Secretary of Commerce, GSA and OMB in their establishment of policies and definition of procedures for Federal agencies to request waivers to mandatory standards.

Promulgate and assure widespread dissemination and implementation of standards.

Develop methods and procedures to monitor Federal agency compliance with and evaluate impact of mandatory standards.

Report annually to OMB and the Congress the progress of the standards program.

This program is conducted under several authorities. The Brooks Act (Public Law 89-306) provides for the economic and efficient purchase, lease, maintenance, operation, and utilization of ADP equipment by Federal agencies. It assigns to the Secretary of Commerce the responsibility to develop and recommend uniform Federal ADP standards, to provide ADP scientific and technological advisory services to Federal agencies, and to undertake the necessary research in computer science and technology. Executive Order 11717 transfers the responsibility for developing Federal data standards from OMB to NBS. OMB Circulars A-108 and A-71 (TM-1) assigns to the Department of Commerce direct responsibilities for issuing standards and guidelines on computer and data security.

In fiscal year 1982, NBS will continue to focus its efforts on the development of standards and guidelines to meet the most immediate and urgent Federal needs in the seven highest priority areas of computer technology identified in the Computer Science and Technology Standards Program Plan. These seven areas are: (1) high level programmining languages, which includes both existing languages originally developed for business and scientific applications (e.g., COBOL, Fortran and Basic) and specialized languages to be standardized for general use and improved productivity; (2) software quality, which addresses management and control of software development projects, the analysis and design of software systems, software testing, and software documentation; (3) computer system and network interfaces which addressed the interconnection of computer system and network components regardless of vendor source; (4) computer security and risk management, which enhances the protection of computer resources through technical and procedural safeguards (such as data encryption to protect data transmission between computers), access and auditing controls, and other security measures as determined by risk analyses; (5) data base management, which addresses data translation, data management application system planning, design and conversion, and data management software design, evaluation and validation; (6) system selection and evaluation, which provides for effective acquisition and efficient operation of computer systems and services; and (7) data elements and representations, which facilitate the sharing and exchange of computer data by assigning uniform definitions and formats to commonly used data names and codes.

Recent accomplishments include:

Development of a standard for Magnetic Ink Character Recognition (MICR) read optically, which will provide for documents printed with magnetic ink characters to be read electronically for direct computer input.

Issuance of a standard for character sets for Optical Character Recognition (OCR), which will improve accuracy in the reading of data by OCR devices.

Issuance of a standard for graphic representation of ASCII controls, which specifies the graphical representation of the 34 characters of the standard character set ASCII which were not included in the original standard.

Planned accomplishments for fiscal year 1983 are to:

Issue a transport protocol standard which will provide for reliable transmission of data between different kinds of computers on a network and allow interconnection of heterogeneous computers and information and resource sharing.

Issue a session protocol standard which will also contribute to interoperability of computers on a network and facilitate resource sharing by establishing a standardized method for user connections and data flow between different computers on a network.

Develop a file transfer standard to enable network users to transmit data between file systems on different host computers on a network.

Develop a guide to software operation and maintenance to help agencies correct errors, improve software, and relieve the heavy cost of software maintenance over the entire software life cycle.

Develop a guide for evaluating software packages to enable agencies to assess the suitability of already developed software packages as an alternative to developing new software for their application.

Develop a data base translation guideline to enable agencies to transfer their data files between dissimilar computer hardware and data base management systems both for operations use and when converting their systems to new hardware.

Develop data base management systems functional specifications guideline that will enable agencies to procure data base management systems without developing their own individual specifications for each application.

Develop a guideline to assist agencies in establishing and maintaining strong comprehensive computer security programs to protect financial and information resources.

4. CORE RESEARCH PROGRAM FOR INNOVATION AND PRODUCTIVITY (SEC. 2(a)(4))................................ $11,586,000

The Bureau Core Research Program for Innovation and Productivity for fiscal year 1983 would include work in four areas: Very Large Scale Integrated Circuits (VLSI); Automated Manufacturing, Robotics, and Metals Processing. With the exception of Robotics, the effort in each area would continue approximately at fiscal year 1982 levels.

This program of research is geared toward removing technological barriers that would otherwise significantly restrain the introduction of new products and processes. Projects are identified and undertaken on the basis of their potential utility for industry. The following criteria are applied in project selection: (1) Opportunities must already be recognized by industry; (2) advancement must depend on the removal of a scientific or technological barrier; (3) the solution must have potentially significant impact on the economy and on industrial productivity; and (4) the solution must require the Bureau's exceptional expertise in measurement and materials.

VERY LARGE SCALE INTEGRATED CIRCUITS.............................. $3,300,000

This program provides the basic measurement science needed by the semiconductor and associated industries to address marketing barriers involving dimensional incompatibility and inability to test against specifications. This program conducts research and develops measurement and calibration methods, reference standards and artifacts, and supporting data, theory, and predictive models required for the removal of market barriers to the manufacture, application, and selling of electronic and electrical materials, components, and systems. The main area of emphasis is: very large scale integrated (VLSI) circuits. An increase of $800,000 over the fiscal year 1982 base program level is the result of a transfer of funds appropriated for the VLSI program that were previously used to purchase equipment and shown in the line "Transfer to the Working Capital Fund" in fiscal year 1982. In fiscal year 1983, the funds will be used for program operations rather than equipment purchase.

The semiconductor efforts provide the technical base for voluntary or de facto standards for semiconductor production equipment, materials, and devices. This effort is concerned with new measurement science demands generated by the greatly decreased (micrometer and submicrometer) dimensions and the vastly increased complexity of VLSI circuits. These demands include tighter control of dimensions, materials purity, and other parameters, as well as new testing concepts. Use of the program outputs will result in the removal of market barriers to material and equipment used by the semiconductor manufacturers and to semiconductor circuits and devices. The removal of these barriers lowers the cost for the manufacturers of goods that incorporate these items. This reduction increases the productivity of such industries as the automobile, computer, communications, and aerospace industries. The removal of market barriers for materials and equipment purchased by the semiconductor manufacturers will increase that industry's productivity. Additional leverage on productivity is achieved for this program when its products are also used to improve the productivity of the manufacturing process. Finally, NBS efforts in VLSI technology will assist American industries in foreign competition with such countries as Japan and Germany, whose governments spend $75 million annually in VLSI research.

charge, and neutral trap densities in thermal oxides.

Develop methods for determining geometry of nonvertical submicron-line edges to allow accurate linewidth measurements on such edges.

Measure high voltage pulses up to 500 thousand volts having a duration down to 1 microsecond with an accuracy better than 0.5 percent.

Complete and document a special 6-port system to provide measurement services and calibrations for voltage, power attenuation, phase shift, and impedance in the range 30 kHz to 10 MHz.

Implement calibration services (for measurement assurance program) for selected characteristics of sources and detectors used in optical fiber communications systems.

Complete and document a national standard for measuring laser beam energy in the spectral range 0.4–15 micrometers to energy levels of 1 nanojoule.

AUTOMATED MANUFACTURING RESEARCH FACILITY____________________ $3,586,000

The discrete parts manufacturing industries produce things one at a time, such as aircraft, auto parts, and machine tools. They produce 75 percent of all U.S. trade in manufactured goods while contributing $150 billion in value added to the Gross National Product. Although this sector of the U.S. economy includes 35 percent of all U.S. firms, over 100,000 of these (or 87 percent of the total) have less than 50 employees. These industries are in a position to reap significant benefits from automation. These industries must be automated to successfully compete in both foreign and domestic markets with Japan, Germany, and other industrial countries. Foreign countries such as Japan and Germany have major national programs in automation.

The completely automated small-batch manufacturing system or flexible manufacturing system consists of such elements as metal cutting machines, computers, terminals, robots, conveyers, measuring or inspection systems, and a host of other mechanisms. For the most part, each of the separate components listed above are produced by independent manufacturers. Therefore, the small-batch manufacturer who wishes to automate must buy various components from various manufacturers. He is then faced with the problem of making the various components work together. Some of the more sophisticated technological companies can do this successfully. However, most of the small-batch manufacturers lack the required technical capability. This lack of ability to readily combine automation equipment from different manufacturers is a serious barrier to the adoption of automation by small-batch manufacturers. Each of the above elements and systems must communicate with one another to receive instructions, report progress on the assigned tasks, and report unplanned events which require remedial action. Each of the multitude of links require an interface between disparate devices and hence an interface for communication protocol. There exists, therefore, the problem of developing the standard interfaces to go in between these various components of the automated facility. The NBS Automated Manufacturing Research Facility provides the technical basis required, primarily by the voluntary standards community, to remove these interface barriers.

The automated manufacturing facility has the measurement function built into the automated manufacturing process. This will replace the manual measurement of parts during or after production. This advancement creates the new problem of maintaining quality control of making the parts to the correct dimensions or shape, during the manufacturing process. In the traditional manual or semi-automatic production environment there exist well recognized quality control systems which provide buyer and seller assurance that the products have the correct dimensions. These systems are supported by NBS calibration programs. This program will develop new physical standards and measurement services to enable the small-batch manufacturer to calibrate his automated facility relative to national standards.

In fiscal year 1982, NBS received a direct appropriation increase of $1,500,000 to continue the establishment of an automated manufacturing research facility. NBS will provide additional direct funding to support the facility and will continue to supplement equipment funding from its general working capital availability. This will allow NBS to: complete the establishment of the facility as described in the fiscal year 1982 budget; and to continue its research program designed to provide the discrete parts manufacturing industry the necessary metrology, data and standards to reap the benefits of automation now enjoyed by the mass production industries.

Finally, NBS will continue its ongoing program to support those manufacturing industries where nonautomated manufacturing and metrology are clearly economically and technically superior. Areas of emphasis will include length, mass, force optical metrology, acoustical metrology, and surface finish.

Planned accomplishments for fiscal year 1983 include:

For the automation manufacturing research facility:

Complete the horizontal machining center work station.

Complete the design and installation of the cleaning and deburring work station.

Complete initial procurement of equipment for the Automated Manufacturing Research Facility.

Define requirements for a new high-level programming language suitable for application to automated process control in batch manufacturing.

Complete assessment of standard protocols for process communications in the batch manufacturing environment.

Demonstrate feasibility of in-process metrology on computer controlled machine tools through extended servo removing geometric, thermal, and dynamic errors.

Assemble and begin testing of a microprocessor network controlled work station featuring machine tool interaction for the development of testing of interface standards.

For the manufacturing-related measurement services:

Complete automation of NBS line scale laboratory permitting reduction in unit cost of calibration of precision rulers or line scale, which are becoming the primary standard for length in American industry, relative to the national standard of length, i.e., the meter.

Demonstrate a new surface roughness measurement technique for the range of 0.1 to 1.0 micrometer using a light-scattering method.

Demonstrate pattern recognition software and hardware for thermal correction of static errors in machine tools.

Develop, test, and demonstrate measurement and location techniques for accurate tool positioning at a work station.

The fiscal year 1983 appropriation will be supplemented by support from the private sector and other government agencies. Industrial support will include research associates and funds for equipment.

Discrete Process Technology (Robotics)—$3,200,000

Robotics is a field technology which is of growing importance to the productivity advancement of manufacturing technology in the U.S. It is also a field where some foreign countries, such as Japan, are technologically ahead of the U.S., and where foreign competition therefore is strong. Advances in the state of the art within the U.S. robotics industry can be materially aided by NBS's development of generally applicable techniques, concepts and standards.

Before robots can make further contributions to productivity improvement they must not only be much more widely used throughout industry, their ability to perform a much wider range of tasks must be improved significantly. The great majority of industrial tasks are currently beyond the capacities of present-day robot technology. Most industrial tasks now performed by humans are too complex or unstructured, or involve too many uncertainties, or require too much ability to see and feel and adapt to changing circumstances to be performed by robots. Although robots now are increasingly used in such operations as spray painting and arc welding, where the positioning of the tools is relatively simple, they are not yet able to perform such tasks as parts assembly. If robots are to perform such more complex tasks, they must be able to execute complex tasks with much greater dexterity, speed and flexibility than they are capable of now.

The Bureau currently has a modest effort in robotics research which is focused on performance measures, programming language standards, better visual and tactile sensors, and hierarchical control strategies. The expanded program in fiscal year 1983 will build on that existing effort.

The objectives of this program during fiscal year 1983 will be:

Continue research and development on sensors needed for robots to see, feel, and determine position of objects.

Improve robot positioning ability in order to permit robots to pick up and deposit an object at a mathematically defined point in space with greater accuracy.

Initiate research on control algorithms needed to permit robots to have increased flexibility.

Develop interface standards between robots, sensors, machine tools, and control computers so that integrated systems can be developed.

Initiate research on robot mobility, including the establishment of the requirements and the mechanical, sensor and logic feasibility.

METALS PROCESSING PROGRAM -- $1,500,000

The Bureau received $3 million in fiscal year 1982 to design and equip a metals processing research facility to address rapid solidification and alloy coating, and also to develop preliminary models and computer software for work in metals phase diagrams.

For fiscal year 1983, direct Bureau support for the program would be decreased by 50% to $1.5 million. In addition to this money, support will come from industry, other government agencies, the American Society of Metals, industrial research associates, and visiting professors and graduate students. This decrease in direct Bureau support is consistent with the policy of transferring a larger portion of the cost of the work performed for specific industries to the private sector.

These funds will permit NBS to continue to develop models which predict the relationship between alloy microstructure and process variables like temperature, mechanical stresses, and composition.

This research has the potential to generate substantial improvements in the fabrication processes, and also, in the development of metals of greatly enhanced performance characteristics (e.g. strength, toughness, corrosion and wear resistance, magnetic permeability, etc.).

At present, the iron, steel, and aluminum industries, which are the high-volume production sectors of our nation's economy, are investigating new metals processing techniques in casting and solidification for technological applications. Examples of such applications include high-energy turbines, automobile engines, structural components, and magnetic materials for use in electric transformers. The principal impediments to progress in the adoption of new processing techniques are the very limited amount of fundamental metallurgical information and scientific understanding relating the internal structure and properties of the final product to the processing conditions. When materials like metal alloys make the transition from liquid to solid, a fine microstructure forms which influences the performance characteristics of the material. There is no predictive base available for optimizing process variables for 1) producing microstructures tailored for a specific end use, 2) scaling processing methods up to industrial level production, 3) designing new alloy systems that would exploit the new technologies, and 4) extending these new technologies to a wider spectrum of the metals industries.

METALS PROCESSING PROGRAM -- $1,500,000

This activity was established in fiscal year 1979 with the recognition by the Executive Office of the President and by Congress that NBS must ensure its technical expertise in order to maintain the capacity to contribute effectively to future national needs and goals. The ability of NBS to respond to directly mandated responsibilities and needs of other Federal agencies arises from the basic technical competence of the NBS staff and a carefully planned program of long-term research. In the previous decade, legislation directing NBS to respond to specific pressing national problems in energy, pollution, consumer interests, and the efficient use of our national resources has caused the Bureau to focus increasingly on short-term problems. The most important impact of the competence building efforts is technology and information transfer from the competence areas to the problem solving areas of NBS, its clientele, and all other interested parties.

The selection of specific competence projects is based on established criteria, for example, the potential for long-range public and economic benefits and the potential for advancing scientific knowledge. After identifying the scientific and technical areas where competence building efforts are needed, the critical size of these efforts and the desirable rate of development are determined and are used to estimate the required resources in personnel, equipment and operating funds. Priorities are determined considering the needs established in the initial assessment process, the impact on industry and society, the available and required funding opportunities to hire expert staff, and other factors. Resources are then allocated to competence efforts in order of priority. Adjustments of funding to specific projects are made depending on changing needs, rate of progress, and technical opportunities.

Some examples of the projects funded to date in the competence program include research in surface science, picosecond laser chemistry, synchrotron radiation techniques, quantum radiometry, compositional mapping, wave optics for metrology, compound semiconductors, cement paste models, gigabit electronics, and biotechnology.

Recent accomplishments in some of these projects include the following:

Developed a direct measurement technique to determine the number of pulses present in the picosecond laser cavity which will significantly reduce errors in experimental data from modern chemical and biological investigations using one-trillionth of a second (picosecond) lasers.

Used pulsed radiolysis techniques to determine the mechanism for free radical-induced changes in the structure of peptides.

This work advances the understanding of chemical interceptors which lessen radiation damage, and has significant applications in food irradiation processing.

Designed and installed hard radiation beam lines and tested prototype equipment for use on the Brookhaven National Synchrotron Light Source, including a real time topographical microradiographic system, a small angle x-ray spectrometer and an extended x-ray absorption fine-structure spectrometer. This equipment will support the development of new techniques for studying the properties of materials under changing conditions and for determining fundamental information on atomic, molecular, and solid state structure.

Extended electromagnetic theory, developed theoretical equations, and computer-modeled the scattering of light pulses from a conducting plane in order to provide a basis for the use of such pulses to measure the size, shape, and optical properties of small objects.

Demonstrated a new electrical technique (photo excited deep level transient spectroscopy) for characterizing the purity and quality of semiconductor substrates used in the manufacture of high speed devices and that circumvents measurement problems usually associated with these semi-insulating materials.

Developed and constructed high temperature, high pressure experimental phase equilibria apparatus for determination of vapor-liquid equilibria and liquid-liquid equilibria of complex fluid mixtures used in industrial chemical processes.

6. FIRE RESEARCH CENTER (Sec. 2(b)(6))--------------------- $4, 991, 000

The goal of this activity is to develop, through research, the technical base necessary to support the Nation's goal of significantly reducing fire losses.

Objectives:

To develop new knowledge of the physical processes of fire as a basis for improved methods of preventing and controlling unwanted fires.

Translate research done into technical publications for use in new test methods and design practices, recommended improvements in building and fire codes, and technical materials for use in the training and education of fire protection professionals.

To develop a validated, physically based predictive method for describing the growth of fire in a building.

To predict the fire behavior of a substance from its physical and chemical characteristics.

The 1983 base for this program includes $3.6 million which was requested in the Federal Emergency Management Agency (FEMA) budget in prior years. The funds were used to support on a reimbursable basis a major portion of the NBS Fire Research program. The $3.6 million is $600,000 less than the 1982 FEMA support. This would result in the termination of test methods on flammability of fabrics and grant work on the effectiveness of the alarm portion of smoke detectors to alert people.

The first priority of this program is the development of the underlying knowledge needed to generate improved fire safety measures. Activities include laboratory and theoretical work on ignition and fire spread and the determination of the role of such phenomena in smoke and toxic gas development. This fundamental work underlies the development of test methods, proposed standards, design specifications, and recommended practices for use by various voluntary standards writing organizations, mandatory standards writing groups in Federal agencies, State and local authorities; and for training and education of fire safety personnel. This fundamental work also has wide applicability to fire safety engineering programs relative to consumer products, building construction, furnishings, fire control systems, and building design concepts. The content and priorities of this program are determined in consultation with FEMA.

The efforts in this activity contribute to our safety and economic welfare. Each year more than 8,000 people die in fires. Over 200,000 fire injuries appear annually on hospital records. In addition to the human suffering, the dollar cost to our economy totals more than $20 billion per year (U.S. Fire Administration publication "Highlights of Fire in the United States," second edition, published December 1980). While most fire deaths occur in private residences, fires in public buildings are particularly damaging; 110 people were killed in two recent major hotel fires. The capacity to reduce fire losses, to reduce the cost of fire protection, and to avoid new fire problems associated with modern designs and materials, depends upon an improved understanding of basic fire phenomenology. At present, the only way to determine a material's fire performance under a given set of conditions is to burn it under those conditions. This situation is impractical and costly and hinders the development of fire resistant materials and effective codes and standards. Methods must be developed to predict fire behavior from fundamental physical properties of materials and their environment.

Recent accomplishments in this area include: (1) An initial analytical room fire growth model has been extended to multiroom configurations. This model predicts the spread of smoke and combustion products which will lead to improved criteria for positioning smoke detectors and smoke control design. Thus a crude mechanism now exists to predict room to room fire spread. (2) A study of effects of thermal radiation on solid phase physical processes preceding ignition has been completed. Thermal radiation is a major factor in surface fire spread. An understanding of the role of the detailed physics and chemistry of substrate behavior under thermal radiation is essential to the development of new materials and fire retardant systems to inhibit fire growth.

Planned accomplishments for fiscal year 1983 include the following:

Extend room fire model to include movement of the flame front on walls and ceilings. This will build upon earlier work, which developed the movement of smoke and hot gases from room to room.

Complete analytical and experimental evaluations of single room fire predictions and begin conversion of the one-room system from a research tool to one which can be used as a practical engineering method.

Correlate small- and full-scale tests for prediction of sprinkler activation. Water is still the most widely used fire suppressant. It needs to be used efficiently to reduce costs and extend the field of application of sprinklers.

Propose test method for the use of oxygen consumption calorimetry as a measure of rate of heat release. This is a new, more accurate, and more widely applicable measurement principle that eliminates the effect of the thermal characteristics of the fire test apparatus.

Develop framework for a standard room fire test. With the fire growth factors included, this test would then become the basis for validating small materials properties tests.

Produce guidelines for design of smokeproof elevators. In high-rise buildings, such as the MGM Hotel in Las Vegas, elevator shafts are a major channel for the transport of noxious and lethal fumes between floors.

7. CENTRAL TECHNICAL SUPPORT (Sec. 2(a)(7))............... $14,324,000

The goals of this activity can be grouped into six areas: (1) *Central Planning*—provide the NBS management a planning framework in the context of a long-term mission and philosophy, which establishes an understanding of the appropriate NBS contributions to national objectives and the specific needs of the users of NBS outputs; (2) *Research Associate Programs*—provide scientists and engineers from industry, academia, and other Federal agencies who demonstrate outstanding promise and ability an opportunity to participate in research programs in the various branches of physical, engineering and mathematical sciences; (3) *Scientific Computing*—provide scientists and engineers with expert collaborative and consultative help in the area of scientific computing; and (4) *Computing Support*—provide computer support which responds to evolving scientific and engineering demands, and which provides the modern computational facilities required by NBS scientists, engineers and administration to achieve the major mission goals of NBS.

CENTRAL PLANNING	$925, 000

This program was established in fiscal year 1979 and continues to assess NBS research priorities and to evaluate NBS long-range opportunities that respond to national needs. Studies are carried out to determine the impact of NBS activities and to analyze the needs of users in both the public and private sectors. Through direction and example, this program assists NBS operating units to incorporate the concepts of economic benefits, impact analyses, and explicit priority setting into their own program planning evaluations. A major activity of this program is the preparation of a long-range plan for NBS, which focuses on strategic issues and program thrusts.

A specific study carried out by this program is the impact of the NBS programs in manufacturing automation on industrial productivity. Another study addresses the impact of NBS programs in the area of how materials affect productivity has been initiated. This program has also begun developing criteria and analytical techniques for use by managers in selecting research areas with productivity impacts. In addition, this program has contributed directly to policy decisions within the Department concerning technological and industrial productivity.

Planned accomplishments in fiscal year 1983 include the following:

Assist the NBS Director to assure optimum use of NBS resources in carrying out its primary responsibility to provide measurement and standards-related services to the technical community.

Conduct evaluations of the economic and social benefits of NBS programs to develop an understanding of the relationships among NBS programs, technological development, and the achievement of national goals with a view to strengthening the Bureau's contributions and establishing program priorities.

RESEARCH ASSOCIATE PROGRAM	$2, 412, 000

This program consists of the Industrial Research Associate program, the Postdoctoral Research Associateship program, and the Graduate Cooperative Education program. These components have the direct effect of maintaining NBS competence by making available high caliber scientific talents to ongoing research programs and provide a mechanism of technology transfer of NBS research and methods to the scientific and engineering communities.

The Industrial Research Associate program is comprised of scientists and engineers from industrial, professional, trade, and other organizations who work at NBS under the sponsorship of their employers who cover all personal expenses. These research associates bring their special expertise to work cooperatively with NBS staff on projects of clear mutual interest, which provides an excellent means of information exchange. Participants in the Postdoctoral Research Associateship program consist of scientists and engineers who have recently earned their Doctorate degree and show outstanding promise and ability. These postdoctorals have been screened by the National Academy of Sciences/National Research Council to work at NBS in the various branches of physical, engineering, and mathematical sciences. They contribute greatly to ongoing research programs at the Bureau and in many cases become permanent employees of NBS. In addition, the Research Associate program serves as an excellent information exchange system and recruitment vehicle through the Graduate Cooperative Education program. Graduate students are appointed to work at NBS to enhance ongoing research programs. Many of these students are hired by NBS upon completion of their graduate work. The latter two programs are fully supported by appropriated funds.

One of the recent accomplishments by the group of postdoctorals has been the development of a practical method for the detection of faults in VLSI circuits currently in use. Another accomplishment in this program has been the completion of initial experiments to provide a measurement basis for theoretical interpretation of the quantized Hall effect (Klitzing effect). This effect may allow the establishment of an "atomic" standard of resistance and a new determination of a fundamental atomic constant, the fine structure constant.

SCIENTIFIC COMPUTING-- $1, 472, 000

This program provides advice and assistance to scientists and engineers at NBS in the choice and use of computing techniques needed in all of NBS technical research programs. Staff in Scientific Computing acquire, adapt, develop, test, evaluate and document scientific computing software and packages, and assist in their use in NBS research programs, thus enhancing the ability of NBS to respond in a modern and effective way to current and future program needs. This program will result in more effective use of time, more efficiency, and better performance since it will allow scientists and engineers to fully utilize their skills in their areas of expertise.

Accomplishments in fiscal year 1981 and fiscal year 1982 include the following:

> Acquire, test, and develop a Core Mathematics Library, that consists of more than 550 software modules which use standardized parameters, are highly portable, have standardized error treatment, and use the best quality tested numerical algorithms to support most effective use of such software by NBS scientists and engineers.
>
> Conduct 25 Scientific Software Tutorial seminars and distribute a Scientific Software Newsletter to more than 800 NBS scientists and engineers to introduce them to recent developments in quality scientific software and numerical analysis techniques.
>
> Develop a Guide to Available Math Software to help NBS scientists and engineers find out what software is available at

NBS to solve their problems, how to obtain operational assistance and provide direction in seeking additional guidelines.

Extend the usefulness and applicability of the Core Mathematics Library by including additional statistical software and adding software obtained from the Department of Energy developed by Sandia, Los Alamos, Technical Exchange Committee Library.

Survey graphics software needs and evaluate appropriateness of available packages for use in NBS applications.

Develop interactive computer program to assist users to choose appropriate software and provide on-line access to available documentation.

In fiscal year 1983, the Scientific Computing program will continue to support the needs of NBS scientists and engineers for guidance and expertise in the sophisticated type of computer programming necessary to apply powerful mathematical techniques to the solution of scientific and engineering problems. Support includes acquisition, development, testing, evaluation, and documentation of scientific software for advanced systems and consulting on its use in NBS applications.

COMPUTING SUPPORT -- $3, 700, 000

In fiscal year 1981 these funds were used for additional external computing services to augment on-site capability as an interim step to the computer replacement. In fiscal year 1982 part of the funds will be used to augment computing resources through a limited capability upgrade of the central computing system which will become part of a proposed 1982 consolidation of four Department of Commerce computing facilities at NBS. The consolidation will enable the Department of Commerce to make substantial savings in administrative ADP costs beginning in fiscal year 1983. In addition, NBS will proceed with procurement of ADP equipment to begin operation of a central computing system for scientific research. Beginning in fiscal year 1982, NBS will begin an arrangement involving an appropriate combination of purchase and lease of computing capacity adequate to provide modernized computing at NBS. Following major procurements in fiscal year 1982, NBS will show a major reduction in computing support consistent with the decision to lease appropriate portions of the system in future years. Procurement of the Central Processing Unit and major peripheral equipment in fiscal year 1982 combined with augmentations in fiscal year 1983 and future years will allow NBS to acquire computing capability adequate to meet its needs at the lowest life-cycle cost. This arrangement will not affect the timing of the system completion and will afford NBS more flexibility in tailoring its system to its needs in future years.

In fiscal year 1982 the initial computing system will be procured, installed and begin operations. Improved computing will more effectively support NBS scientists in such tasks as analyzing and reducing experimental data, and preparing and disseminating the results of research. A modern system facility will have the following benefits:

Encourage replacement of time-consuming and expensive experiments by analysis of appropriate models.

Reduce non-productive time spent by scientists and engineers in seeking sources of computer service and in waiting for the results of computer runs.

Make possible much more rapid organization and search of stored data, and timely preparation of reports for general dissemination or responses to individual requests for information.

Allow for closer coordination with up-to-date information systems in use in industry, commerce, other Government agencies, and research institutions.

TRANSFER TO THE WORKING CAPITAL FUND______________________________ $5,186,000

The funding level of $5,186,000 in fiscal year 1983 will permit NBS to finance $3,049,000 to recover the replacement value of the NBS general equipment inventory that has been eroded by inflation, to provide $1,454,000 for production of SRM's, including $1,184,000 for additional renewal SRM's that represent the last increment of the four-year capital expansion plan, $500,000 for equipment purchases associated with prior year program initiatives, and $183,000 to fund the increased liability of the funded leave account as a result of the October 1981 pay raise.

The inflation adjustment of $3,149,000 is necessary to maintain the replacement value of the present general equipment inventory and is described in detail in the adjustments to base for equipment. This adjustment will permit NBS to replace equipment where there is a critical need to take advantage of automation and other developing technologies that lead to more efficient laboratory operations. Future inflation will be met each year by independent adjustments to base. The SRM program includes $1,184,000 as the last increment of a four year expansion program as well as $370,000 for normal SRM production. This amount ($370,000) includes an increase of $120,000 for adjustments to base, of which $48,000 represents increased pay costs in fiscal year 1983. Equipment purchases in the amount of $500,000 from prior year program initiatives represent the last increment of equipment for the materials durability program ($300,000) funded in fiscal year 1980 and the VLSI program ($200,000) funded in fiscal year 1981. The VLSI equipment ($200,000) is the last increment of funds appropriated in fiscal year 1981. In each of fiscal years 1982 and 1983, $800,000 was converted to operating funds and placed in the Technical Support to Industrial Productivity subactivity.

FACILITIES MODIFICATIONS AND IMPROVEMENTS__________________________ $629,000

Regular improvements, replacements, and modifications to existing laboratories and buildings and the systemmatic replacement of aging facilities and equipment are provided for in this line item. The fiscal year 1983 sum of $629,000 will permit NBS to accomplish the most urgent and necessary modifications, replacements, and improvements. The National Bureau of Standards facilities in Gaithersburg (16 years old) and Boulder (26 years old) continually need minor improvements, modifications, and repair or replacement to avoid system failures caused by old, worn-out equipment. On occasion, extraordinary repairs are necessary to restore facilities damaged by natural causes. Modifications needed to meet the minimum requirements to make the facilities accessible to the handicapped which are required by law, must be made and the equipment replacement program to systematically replace facilities as they age or become obsolete must be continued to assure the usefulness of existing laboratories and other buildings.

NATIONAL TECHNICAL INFORMATION SERVICE

(Sec. 4)	$1,980,000

The National Technical Information Service (NTIS) was established as a primary operating unit of the Department of Commerce by order of the Secretary on September 2, 1970. The Director of NTIS is required to promote technological, scientific, economic, business and engineering information to business, industry, State and local governments and related organizations. NTIS collects and promotes the availability of documents, film, patents and magnetic tape from Government activities that produce information.

The NTIS goals and objectives are achieved through three current programs; the Information Clearinghouse Program; the Patent Licensing Program; and the Technology Transfer Program. In addition, the Computer Enhancement Program is required to finance the upgraded computer system in fiscal years 1982 and 1983.

INFORMATION CLEARINGHOUSE PROGRAM	SELF-SUSTAINING

This program encompasses the public sale of Government-sponsored technological, scientific, economic, business, and engineering reports, and other analyses prepared or sponsored by National and local governmental agencies, by Federal agencies, their contractors or grantees. The primary objectives of the program are: (1) to provide this information to the public; (2) to do so on a financially self-sustaining basis; and (3) to maximize the efficiency and effectiveness of the system to provide an acceptable level of customer service. In fiscal year 1981, the program became totally self-sufficient for all routine operating costs.

PATENT LICENSING PROGRAM	$100,000 (+$400,000)

This program seeks to improve productivity and encourage innovation in the domestic economy through the licensing of U.S. Government invention technology. It also seeks to bring selected inventions to the attention of U.S. industry through direct industry contacts and specialized marketing strategies, prevent unrestricted, uncompensated foreign use of U.S. Government invention technology, and protect important foreign markets for U.S. trade and development by the filing of foreign patent applications on selected inventions. This program provides the mechanism for greater utilization of the 31,000 inventions to which the Government has title and are available for licensing. The bill provides $100,000 for the Patent Licensing Program in fiscal year 1983 to maintain foreign licenses in effect. All other program costs ($400,000) will be recovered through reimbursements from the Office of Productivity, Technology and Innovation (OPTI).

TECHNOLOGY TRANSFER PROGRAM	$252,000

This program seeks to improve the economic enhancement of U.S. firms as well as increase the world competitive position of American industry. The emphasis is directed toward stimulating and supporting U.S. industrial innovations and productivity. Two subprograms exist to achieve this objective: (1) the Foreign Technology Acquisition program collects, translates and disseminates scientific and technical information originating outside the U.S. that is determined to be of value to U.S. industry. As much as two-thirds of all Research and Development is not being performed outside the U.S. This program provides for the utilization of foreign technological and scientific advances within the U.S. industrial sectors; and, (2) the Dissemination of Patent Information program provides greater accessibility to patent information by abstracting and indexing patent documents to align them with the needs of the research community. The bill provides $252,000 for the Technology Transfer Program in fiscal year 1983.

COMPUTER ENHANCEMENT -- $1,628,000

An upgraded computer system will significantly improve the efficiency, effectiveness, and productivity of NTIS operations by replacing unreliable outmoded IBM Model 360/65's with reliable current generation equipment. Upgrading the computer system will enable NTIS to broaden the support of existing ADP applications which could not be supported by the interim 360/65's. NTIS will develop new programs and replace batch-oriented processing with on-line data base oriented application systems. NTIS will be able to provide product design capabilities for creating custom data base products from existing Federal data bases, create specialized data products, and correlate customer interests and trends to produce specialized data products. The present computers and their existing programmed applications are unable to meet the basic production requirements or meet the additional workload requirements. The bill provides $1,628,000 for Computer Enhancement in fiscal year 1983 which is the final year of a two-year funding plan for an upgraded computer system.

OFFICE OF PRODUCTIVITY, TECHNOLOGY AND INNOVATION

(Sec. 5) -- $1,898,000

The Office of Productivity, Technology and Innovation seeks to promote the technological innovation and productivity and advance the competitive capability of the nation's products and services in the world market through three main activities: research studies for innovation and productivity policy, coordination of Federal patent policy, and the promotion of the voluntary conversion to the Metric System.

STUDIES FOR INNOVATION AND PRODUCTIVITY POLICY ------------------------- $798,000

This program would carry forward a series of policy studies aimed at improving policies for industrial productivity, technology, and innovation. The thrust of these studies is to find better ways to stimulate private sector productivity through the development of appropriate public policies and by providing productivity-related information and technical assistance.

The work would consist of the following:

Barrier identification and removal—In consultation with private sector, other Government, and in-house data sources, information is gathered on key factors (public or private) impeding productivity growth. This analyzed to determine its policy implications, and public or private actions are developed to mitigate or eliminate these barriers. Of particular importance, is OPTI's role in examining the impact of Government policies (regulatory, fiscal, etc.) on private-sector productivity growth. Policy analyses and decision packages are prepared and presented for the new National Productivity Advisory Committee and for the Cabinet Council on Economic Affairs.

Measurement—Increased private sector understanding of the importance of productivity measurement techniques is promoted. Trade association, firms, and professional groups also are assisted through OPTI's provision of: better access to specific Government measurement information, materials on the definition and measurement of productivity at the firm level, and technical assistance in data collection procedures and analysis.

Information and outreach—Through a national clearinghouse/resource center, information on productivity improvement methods is collected and disseminated upon request (or through workshops and seminars) to provide U.S. firms and business organizations with tested practical tools for enhancing productivity. GAO, private sector productivity centers, and industry have identified this function as an essential Government responsibility (i.e., one which does not compete with private information activities) needed especially by small- and medium-sized firms.

Coordination—The Department's research, data collection, and other productivity-related programs are coordinated by defining broad program goals, developing cooperative projects, reviewing accomplishments, and recommending improvements. Through a Departmental Productivity Steering Group and an extensive inventory of Departmental productivity activities, OPTI serves as the principal contact on all productivity-related issues raised by the National Productivity Advisory Committee, the Cabinet Council on Economic Affairs, the Congress, and the private sector.

Government inventions program—Federally owned patents for commercialization by the private sector are licensed. The functions administered include identifying, promoting, and collecting royalties on marketable Government-owned inventions from the approximately 20,000 items in the Federal patent portfolio. This program is designed to stimulate highes productivity, to create new jobs, and to enhance the effective utilization of resources.

Cooperative technology—OPTI issues public procedures for limited Department of Commerce assistance to centers for industrial technology, provides such assistance, and works with the Department of Justice on antitrust questions.

Technology diffusion--A data base of Federally funded technology sources (there are over 700 Federal laboratories), programs, and problems is maintained. OPTI leads and coordinates interagency efforts to expand technology diffusion to the private sector: Federal agencies with large research and development programs are encouraged to maximize their diffusion process and responses to requests for technical assistance from State and local governments are coordinated.

Research and information—OPTI handles the numerous requirements contained in Section 5c of the Stevenson/Wydler Technology Innovation Act for studies, assessments, policy experiments, etc. involving the relationship of technology and the U.S. economy (e.g., employment, trade, and capital formation).

COORDINATION OF FEDERAL PATENT POLICY -- $400,000

This program would coordinate, montior, and perform data-gathering/reporting functions on Federal patent policy including promotion of private sector opportunities for commercializing inventions resulting from projects financed with Federal Government funds. The Patent and Trademark Amendments Act of 1980 (P.L. 96-517) included provisions to give small business and non-profit organizations (including universities) a first right of refusal to title to inventions made with Government funding. In addition, Government agencies are encouraged to grant exclusive licenses for Government-owned inventions. Unless these inventions are commercialized (i.e., actually reach the marketplace) little or no benefit will be realized. Federal patent policy is an element of technology transfer and has a relationship to certain sections of the Stevenson-Wydler Technology Innovation Act (P.L. 96-480). This program will provide a centralized focus for oversight and evaluation of the implementation of the new patent policy and the response of the private sector to the new policy. Patent policies of other nations will also be examined.

This program would perform the following functions:

Assist the Executive Office of the President and affected Federal agencies in developing the statutory and administrative procedures necessary to establish and monitor a uniform patent policy, and undertake the management, oversight, and evaluation of this policy to assure its effectiveness. The Department does not plan to issue procedures which are binding on other agencies or attempt to resolve individual disputes between an agency and an aggrieved party.

In coordination with other agencies, collect and publish data on individual agency implementation of the Patent and Trademark Amendments Act, Executive Office requirements, and contractor patent activities. It should be noted that the Patent and Trademark Amendments Act will result in a reversal of some agency practices; accordingly, this monitoring and coordination function would be especially critical in the first several years.

In coordination with other agencies and in conjunction with the data collection function, establish uniform invention report forms, utilization report forms, criteria for filing patent applications on Government-owned inventions, and standards for disposition of Government-employee inventions. In the absence of uniform Government-wide standards, agency management of patents has been uneven and inefficient. Sound criteria for filing patent applications on Government-owned inventions and a uniform invention report form will reduce public paperwork and regulatory burdens.

Evaluate the effectiveness of the Patent and Trademark Amendments Act and Executive Office procedures and, in coordination with other agencies, make recommendations for legislative or regulatory changes, as appropriate.

Convene conferences/workshops to assist Federal agencies, businesses, and universities to implement the new Federal patent policy. Such workshops would have as a primary objective the provision of information on how to get access to patent rights on Federally-funded inventions and on Federal policies regarding the commercialization of those inventions. In addition, information could be provided on other Government small business and university programs on the commercialization of innovations.

Chair a Federal agency committee to provide information and guidance to assist the Department in performing its Federal patent policy functions. Such a committee could be operated under the Federal Coordinating Council for Science, Engineering, and Technology which is administered by the Office of Science and Technology Policy. This committee also would include the grantee/contractor community and other private sector organizations.

Coordinate administration positions on proposed legislation related to ownership of inventions made with Government support. This function would be supported by the Department's data base on agency implementation of Federal patent policy and its chairmanship of the committee cited above.

Monitor the Federal patent policy and procedures of other key trading partners and the rights of U.S. companies in acquiring patents owned by foreign governments.

Monitor related technology transfer functions of Federal agencies as such agencies seek to diffuse their technology to U.S. industry by means other than through patent rights.

VOLUNTARY CONVERSION TO THE METRIC SYSTEM_____________________ $300,000

This program would administer those Federal functions and responsibilities related to promoting the voluntary conversion to the metric system in the United States.

The Metric Conversion Act of 1975 established the United States Metric Board to coordinate voluntary conversion to the metric system. In Fiscal Year 1982, the Metric Board is proposed for termination after it was determined that many of its functions could be performed by private industry or by non-Governmental organizations such as the American National Metric Council.

In March 1981, the private sector's American National Metric Council conducted a survey on the roles of the Government and the private sector in metrication. The following are some relevant findings: 90 percent felt that the Federal Government should coordinate its activities (51 percent wanted more effort here); 75 percent indicated that Government should perform public awareness and education (with 61 percent wanting more effort than now).

Certain functions should remain which are the responsibility of the Federal Government, and which should be continued because of the importance of voluntary conversion to the national economy. This importance is particularly evident in connection with Commerce Department functions (e.g., U.S. international trade) since all of our major trading partners have adopted the metric system. The Common Market has even issued deadlines after which metric units must be used by member states.

At the direction of the Administration, the residual Federal functions and responsibilities for voluntary metric conversion have been assigned to the Department of Commerce. These include:

Responding to inquiries from business and the public concerning the metric system, the status of conversion in the various sectors of industry, and sources of specific metric data needed by business.

Coordinating the Federal Government's own metric conversion activities, including responsibility for the Interagency Committee on Metric Policy and for the maintenance of a consistent Federal position. In addition, advice and assistance will be provided to State and local governments in this area.

Identifying existing barriers to voluntary conversion to the metric system and recommending approaches for their removal. These barriers can include: legislative restrictions which obstruct the introduction of metric units; uncoordinated conversion actions within the Governmental sector which adversely impact private industry activities; lack of information about progress in metric conversion within the United States and in foreign countries which prevents the coordination of conversion programs across related economic sectors; diffuse international representation which retards the acceptance of U.S. engineering practices or products; and identification of areas where lack of suitable standards is inhibiting conversion.

Providing a focal point for liaison among the Federal Government, private industry, and non-Federal organizations concerned with metric conversion for the exchange of information and to ensure that the Federal Government is aware of the views and problems of business and industry concerning metric conversion.

Serving as a Government focal point with metric capability to provide information to (and sometimes to protect) U.S. business interests, as for example, when a foreign country decides to accept products only if labelled in metric modules (i.e., prohibiting "soft" conversion from inch-pound to metric units, thereby compelling actual changes in old inch-pound dimensions). It is reported that a U.S. lumber broker lost an initial export order of $10 million and potential follow-on orders of $300 million because he could not find a U.S. mill that would cut to metric dimensions. (The initial order went to Canada.) A recent private sector survey found that of the businesses surveyed, 16 percent lost export business because it was not feasible to produce to metric specifications.

No longer is the United States the undisputed leader in all high technologies. United States advanced technology products and processes formerly were accepted universally without hesitation. With the recent loss in several high-technology areas to such countries as Japan and West Germany, the importance of export marketability of U.S. output has become critical. Although decisions by U.S. exporters to go metric rests with the private sector, the U.S. Government can provide a valuable service by providing guidance and information upon request. In the absence of a U.S. Government focal point, business leaders will be unable to properly communicate their views on metrication to the Executive Branch.

Acting as an intra-government coordinator to prevent mixed and conflicting Federal agency signals on metrication. Such signals can: unnecessarily delay private sector decisions to the advantage of the new tax provisions concerning capital investment whether to incorporate metric capability or not), thereby foregoing productivity advances: produce uncertainty as industries seek to plan their own conversion timetables (e.g., where several Federal agencies are involved, such as the construction industry), and foster uncertainty and inaction among State and local governments.

6. SECTIONAL ANALYSIS OF THE BILL

H.R. 5726

A bill to authorize appropriations for activities of the National Bureau of Standards, and for other purposes.

SECTION 1

This section provides the short bill title "National Bureau of Standards Authorization Act for Fiscal Year 1983."

SECTION 2

This section authorizes appropriations to the National Bureau of Standards for fiscal year 1983 in the amount of $124,019,000. The budget activities are authorized as follows:

(1) Measurement Research and Standards, $50,389,000.
(2) Engineering Measurements and Standards, $21,012,000.
(3) Computer Science and Technology, $12,731,000.
(4) Core Research Program for Innovation and Productivity, $11,586,000.
(5) Technical Competence Fund, $8,986,000.
(6) Fire Research Center, $4,991,000.
(7) Central Technical Support, $14,324,000.

This section also provides that, of the funds authorized for Measurement Research and Standards, not less than $1,200,000 shall be available for the Office of Weights and Measures.

This section also provides that, of the funds authorized for Engineering Measurements and Standards, not less than $500,000 shall be available for the purpose of Earthquake Hazards Engineering.

This section also provides that, of the funds authorized for Measurement Research and Standards and Engineering Measurements and Standards, not less than $1,000,000 shall be available for Measurement Standards for the Handicapped.

This section also provides that, of the funds authorized for Computer Science and Technology, not less than $10,000,000 shall be available for Computer Science and Technology.

This section also provides that, of the funds authorized for the Core Research Program for Innovation and Productivity, not less than $3,000,000 is authorized for the purpose of Automated Manufacturing Research Facility and $3,200,000 for Discrete Process Technology (Robotics).

This section also provides that, of the funds authorized for the Core Research Program for Innovation and Productivity and for Central Technical Support, not more than $5,386,000 shall be available for Transfer to the Working Capital Fund.

SECTION 3

This section authorizes $500,000 in excess foreign currencies for expenses of the Bureau incurred outside the United States.

SECTION 4

This section authorizes $1,980,000 in funds to be appropriated for activities performed by the National Technical Information Service.

SECTION 5

This section authorizes $1,898,000 in funds to be appropriated for activities in the field of innovation and productivity by the Office of Productivity, Technology and Innovation.

SECTION 6

This section provides for salary adjustments to be made proportionally from line items in section 2(a), and in sections 4 and 5, if appropriations are not authorized.

SECTION 7

This section provides that funds appropriated pursuant to this Act shall remain available for expenditure and obligation according to such provisions as the appropriations acts may specify.

SECTION 8

This section provides that funds may be transferred into, or out of any line item in section 2(a) up to an amount equal to 10 percent, provided that if the Bureau wishes to transfer sums in excess of 10 percent, notification must first be given to the appropriate House and Senate Committees, and then a 30-day waiting period must be observed unless each committee agreed to the action prior to that time.

SECTION 9

This section requires the Secretary of Commerce to charge for services rendered by the Bureau to other government agencies or in compliance with any statute unless funds are specifically appropriated for that purpose, or the costs are nominal.

7. OVERSIGHT ACTIVITIES

Pursuant to Clause 2 (1) (3) (A), Rule XI, and under the authority of Rule X, Clause 2(b) (1) and Clause 3(f), of the Rules of the House of Representatives, the following statement on oversight activities is made.

Committee oversight of the National Bureau of Standards from May 1981 through April 1982 has consisted principally of hearings, inspection of the NBS facility at Gaithersburg, Md., staff attendance at NBS meetings, analysis of CRS reports and GAO studies, and meetings and informal discussion between committee members and staff and NBS representatives.

The Committee's oversight findings and recommendations are contained in the body of this report.

Hearings

Testimony was given by NBS witnesses and others appearing at hearings held by the committee between June 1981 and February 1982 as follows:

June 16, 17, 1981 NBS Organic Act Review
February 9 and 10, 1982 NBS Authorization

Inspection of NBS facility at Gaithersburg, Md.

June 8, 1981—Members and staff of the committee visited the research facilities in Gaithersburg, Md. for the purpose of program and facility familiarization.

Attendance at NBS meetings

Committee staff members have met with NBS personnel to receive various briefings on budget and program matters.

Plans

During the coming year the Committee plans for NBS oversight include:

Review of selected programs and projects of the NBS.

Analysis of the hearings and studies conducted to date on the future role of NBS and redrafting of the bill to amend the NBS organic Act.

Review of NBS's implementation of recent statutory mandates.

Review of OPTI's work on innovation and productivity.

Review of OPTI's implementation of the Metric Act of 1975.

8. OVERSIGHT FINDINGS AND RECOMMENDATIONS BY THE COMMITTEE ON GOVERNMENT OPERATIONS

Pursuant to Rule X, Clause 2(b)(2) and Rule XI, Clause 2(1)(3)(D) of the Rules of the House of Representatives, the following oversight findings and recommendations made by the Committee on Government Operations have been received: No statement of findings and recommendations was received as of May 3, 1982.

9. CONGRESSIONAL BUDGET ACT INFORMATION

This bill provides for new authorization rather than new budget authority and consequently the provisions of section 308(a) of the Congressional Budget Act of 1974 are not applicable. No authorization for State or local financial assistance is included in the bill.

10. COST ESTIMATE, CONGRESSIONAL BUDGET OFFICE

U.S. Congress,
Congressional Budget Office,
Washington, D.C., April 8, 1982.

Hon. Don Fuqua,
Chairman, Committee on Science and Technology, U.S. House of Representatives, Rayburn House Office Building, Washington, D.C.

Dear Mr. Chairman: Pursuant to Section 403 of the Congressional Budget Act of 1974, the Congressional Budget Office has prepared the attached cost estimate for H.R. 5726, the National Bureau of Standards Authorization Act for Fiscal Year 1983.

Should the Committee so desire, we would be pleased to provide further details on this estimate.

Sincerely,

Alice M. Rivlin, *Director.*

Congressional Budget Office Cost Estimate

April 8, 1982.

1. Bill number: H.R. 5726.

2. Bill title: National Bureau of Standards Authorization Act for Fiscal Year 1983.

3. Bill status: As ordered reported by the House Committee on Science and Technology. April 1, 1982.

4. Bill purpose: This bill authorizes the appropriation of $128.4 million for fiscal year 1983 for programs administered by the National Bureau of Standards (NBS), the National Technical Information Service (NTIS), and the Office of Productivity, Technology, and Innovation (OPTI). It also authorizes such sums as may be necessary for adjustments in salaries and benefits required by law.

Fiscal year 1982 appropriations to date for the programs authorized by the bill are $126.2 million. The President's fiscal year 1983 budget requests $120.4 million for these activities. The authorization levels in the bill include $124.0 million for NBS, $2.0 million for NTIS, and $1.9 million for OPTI. In addition, $500,000 in excess foreign currency is authorized for 1983 for the expenses of NBS incurred outside the United States.

5. Cost estimate:

[By fiscal years, in millions of dollars]

	1983	1984	1985	1986	1987
Authorization level:					
Specified	128.4				
Estimated	6.9				
Total	135.3				
Estimated outlays	101.6	29.1	4.1		

Including outlays from prior years' budget authority enacted to date, total outlays for these programs would be approximately $130 million in fiscal year 1983, assuming the funding levels authorized in the bill.

The costs of this bill fall primarily within budget subfunction 376.

6. Basis of estimate: For the purpose of this estimate, it is assumed that the entire amount authorized in H.R. 5726 will be appropriated prior to the beginning of fiscal year 1983. In addition, based on CBO's current economic assumptions, it is estimated that approximately $6.9 million in fiscal year 1983 will be provided for adjustments in salaries and benefits. Outlays reflect historical spendout rates for the programs of the NBS. Based on information from the Department of Commerce, no outlays are assumed to occur as a result of the $500,000 authorized for expenses incurred outside the United States, and to be paid in excess foreign currencies.

7. Estimate comparison: None.

8. Previous CBO estimate: On April 2, 1982, CBO prepared a cost estimate for S. 2271, the National Bureau of Standards Authorization Act for Fiscal Year 1983, as ordered reported by the Senate Committee on Commerce, Science, and Transportation on March 29, 1982. S. 2271 provided for the authorization of appropriations in fiscal year 1983 of $111.5 million for NBS and $2.0 million for NTIS, plus adjustments for pay and benefits.

9. Estimate prepared by: Mary B. Maginniss.

10. Estimate approved by:

JAMES L. BLUM,
Assistant Director for Budget Analysis.

11. COST AND BUDGET DATA

The bill would authorize appropriations for Fiscal Year 1983 in the amount of $127,897,000. In addition, $500,000 in excess foreign currency is authorized for 1983 for the expenses of NBS incurred outside the United States.

In accordance with the requirements of section 252(b) of the Legislative Reorganization Act of 1970, the Committee's estimate for the National Bureau of Standards and related agencies for the next five years is as follows:

Fiscal Year:	
1983	$127, 897, 000
1984	134, 300, 000
1985	140, 800, 000
1986	147, 400, 000
1987	154, 200, 000

12. EFFECT OF LEGISLATION ON INFLATION

The anticipated inflationary impact of this legislation has been assessed in accordance with Rule XI, Clause 2(l)(4) of the Rules of the House of Representatives. No inflationary effect on prices and costs in the national economy is expected.

Expenditures by the National Bureau of Standards are, with few exceptions, for basic and applied measurements and standards related research within the Bureau's laboratories.

These enhanced R. & D. capabilities will encourage expansion of existing links between the Bureau's scientists and laboratories and industry. This will provide for more effective transfer of innovative research findings into the industrial sector. In this manner both national industrial productivity and competitiveness will be improved.

A number of economic studies have directly and indirectly indicated that the contribution of basic and applied research and development and innovation to economic growth, increased productivity, and favorable international trade balances is high. Increased productivity and comparative advantages in international trade are generally regarded as very effective measures in combatting inflation.

While there is a time lag and a degree of uncertainty in the innovation process from the conceptualization of an idea in a research setting to the commercialization of a new product or process, the importance of R. & D. in the innovation process and its ultimate impact upon industrial productivity cannot be denied. This has been a major premise in the establishment and continued funding of the Bureau.

13. COMMITTEE RECOMMENDATION

A quorum being present, the bill was ordered reported on April 1, 1982 by the Committee by a rollcall vote of 23 yeas and 17 nays.

14. ADMINISTRATION VIEWS

The following letter from the Secretary of Commerce accompanied a draft legislative proposal recommended by the Administration. This was introduced by Mr. Fuqua on March 4, 1982 as H.R. 5725.

THE SECRETARY OF COMMERCE,
Washington, D.C., February 8, 1982.

Hon. THOMAS P. O'NEILL, Jr.,
Speaker of the House of Representatives,
Washington, D.C.

DEAR MR. SPEAKER: Enclosed are six copies of a draft bill "To authorize appropriations to the Secretary of Commerce for the programs of the National Bureau of Standards for fiscal years 1983 and 1984, and for other purposes", together with a statement of purpose and need in support thereof for consideration by the House of Representatives.

We have been advised by the Office of Management and Budget that there is no objection to the submission of this legislation to the Congress from the standpoint of this Administration's program and that enactment of this legislation would be in accord with the program of the President.

Sincerely,

MALCOLM BALDRIGE,
Secretary of Commerce.

Enclosures.

ENCLOSURE 1

A BILL To authorize appropriations to the Secretary of Commerce for the programs of the National Bureau of Standards for fiscal years 1983 and 1984, and for other purposes

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That this Act may be cited as the "National Bureau of Standards Authorization Act for Fiscal Years 1983 and 1984".

AUTHORIZATION FOR PROGRAM ACTIVITIES

SEC. 2. There are authorized to be appropriated to the Secretary of Commerce to carry out activities performed by the National Bureau of Standards for the following line items:

(a) Measurement Research and Standards, $49,980,000 for fiscal year 1983, and such sums as may be necessary for fiscal year 1984;

(b) Engineering Measurements and Standards, $32,872,000 for fiscal year 1983 and such sums as may be necessary for fiscal year 1984; and

(c) Central Technical Support, $21,510,000 for fiscal year 1983 and such such sums as may be necessary for fiscal year 1984.

NATIONAL TECHNICAL INFORMATION SERVICE

SEC. 3. In addition to the sums authorized to be appropriated by section 2 of this Act, there are authorized to be appropriated to the Secretary of Commerce $1,980,000 for fiscal year 1983 and such sums as may be necessary for fiscal year 1984 to carry out activities performed by the National Technical Information Service.

SALARY ADJUSTMENTS

SEC. 4. In addition to the sums authorized to be appropriated by sections 2 and 3 of this Act, there are authorized to be appropriated for each of the fiscal years 1983 and 1984 such additional sums as may be necessary to make any adjustments in salary, pay, retirement, and other employee benefits which may be provided for by law, and, if the full amount necessary to make such adjustments is not appropriated, the adjustments shall be made proportionately from section 3 and from the line items in section 2 in a manner reflecting the extent to which the amount of section 3 and of each line item in section 2 is attributable to employee benefits of the type involved.

AVAILABILITY OF APPROPRIATIONS

SEC. 5. Appropriations made under the authority provided in this Act shall remain available for obligation, for expenditure, or for obligation and expenditure for periods specified in the Acts making such appropriations.

ENCLOSURE 2

STATEMENT OF PURPOSE AND NEED

The National Bureau of Standards (NBS), the Nation's oldest national laboratory and lead agency for measurement science and standards, was created by the Act of March 3, 1901 (Pub. L. No. 56–177; 15 U.S.C. 271–278h) (hereinafter cited as the "Organic Act" or "Act"). Pursuant to that Act, the Secretary of Commerce is authorized to undertake certain functions including: the custody, maintenance, and development of the Nation's standards of physical measurement and provision of means and methods for making measurements consistent with these standards; the determination of physical constants and properties of materials; the development of methods for testing materials, mechanisms, structures, supplies and equipment; cooperation with other Federal agencies and the private sector in the establishment of standard practices; the provision of advisory services to government agencies on scientific and technical problems; and the invention and development of devices to serve special national needs.

Since its creation in 1901, and until fiscal year 1979, the Organic Act served as a continuing authorization of appropriations for Organic Act activities. In 1978, the Congress in Public Law No. 95–322 amended section 18 of the Organic Act (15 U.S.C. 278h) to limit to fiscal years 1979 and 1980 the period for which appropriations under the Act were authorized. In 1980, the Congress in Public Law No. 96–461 repealed that amendment thus restoring the continuing authorization of appropriations for Organic Act activities. However Public Law No. 96–461 also limited to fiscal years 1981 and 1982 the authorization of appropriations for all of NBS' activities and operations including those performed under the Organic Act and under other statutes such as the Standard Reference Data Act (15 U.S.C. 290–290f) and section 5(d) of the Earthquake Hazards Reduction Act of 1977 (42 U.S.C. 7704(d)). Public Law No. 96–461 also specifically included an authorization of appropriations limited to fiscal years 1981 and 1982 for those activities of the National Technical Information Service (NTIS) which are funded by appropriations. The primary purpose of this bill is to extend through fiscal years 1983 and 1984 the authorization of appropriations for the Bureau and NTIS.

Section 2 authorizes appropriations to the Secretary of Commerce to carry out the following line item activities of the National Bureau of Standards: $49,980,000 for fiscal year 1983 and such sums as may be necessary for fiscal year 1984 for Measurement Research and Standards; $32,872,00 for fiscal year 1982 and such sums as may be necessary for fiscal year 1984 for Engineering Measurements and Standards; and $21,510,000 for fiscal year 1983 and such sums as may be necessary for fiscal year 1984 for Central Technical Support. These items include NBS's Organic Act activities (including fire research activities conducted under the authority of amendments to the NBS Organic Act made by section 18 of the Federal Fire Prevention and Control Act of 1974) and NBS' activities under other statutes such as the Standard Reference Data Act and section 5(d) of the Earthquake Hazards Reduction Act of 1977.

Section 3 authorizes appropriations for the National Technical Information Service. The Act of September 9, 1950 (64 Stat. 823–824; 15 U.S.C. 1151–1157) directed the Secretary of Commerce to establish a clearinghouse for the collection and dissemination of scientific, technical and engineering information. The Secretary established, within the National Bureau of Standards (NBS), the Clearinghouse for Federal Scientific and Technical Information to perform the clearinghouse function. Later, through issuance of Department Organization Order 30–7A in September 1970, the Secretary created a new operating unit of the Department of Commerce, the National Technical Information Service (NTIS), and reassigned the clearinghouse function to it.

NTIS is the central source for the public sale of research, development and engineering reports and other analyses prepared by Government agencies, their contractors and grantees, and selected non-Governmental entities. It is also the central source for sales of Government-generated computer-processable data files. Pursuant to Section 3 of the Act of September 9, 1950 (15 U.S.C. 1153), NTIS sells its products and services on a self-sustaining basis. Gross sales are about $22 million annually. Eighty-five percent of revenues come from sales to the public; the remainder derives from sales to Government agencies.

NTIS also performs a few activities funded by appropriations. The Congress in Public Law No. 96-461 authorized appropriations for these activities of the National Technical Information Service for fiscal years 1981 and 1982 and to pay the first year costs of a 2-year program to modernize NTIS's computer system. Section 3 of this bill authorizes the appropriation to the Secretary of Commerce of $1,980,000 for fiscal year 1983 and such sums as may be necessary for fiscal year 1984 to carry out those programs and activities of NTIS which are funded by appropriations and to pay the second (final) year costs of the 2-year NTIS computer system modernization program.

Section 4 authorizes the appropriation of such additional sums as may be necessary to make any adjustments in salary, pay, retirement, and other employee benefits which may be provided for by law. If the full amount necessary to make such adjustments is not appropriated, then section 4 provides that the adjustments be made proportionately from section 3 and from the line items in section 2 in a manner reflecting the extent to which the amount of section 3 and of each line item in section 2 is attributable to employee benefits of the type involved.

Section 5 provides that appropriations made under the authority provided in this Act shall remain available for obligation, for expenditure, or for obligation and expenditure for periods specified in the Acts making such appropriations. The final determination whether to limit the availability of an appropriation to a single year or on a multiple-year basis is made when an appropriation bill is enacted by the Congress. An appropriation bill providing for other than a single-year availability would be subject to a point of order if an authorizing statute had not previously been enacted. Section 5 of this bill provides this necessary authority. In addition most research and development organizations are subject to uncertainties inherent in research programs, to a high incidence of unpredictable factors that compel the readjustment of program activities, and to the need for flexibility to permit prompt response to changed circumstances. Section 5 also provides for this necessary flexibility for the scientific and engineering research programs of NBS.

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